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HYDROELECTRIC DEVELOPMENT.

The question of the proper method of developing the water powers upon the public domain of this country is one which has been brought prominently before the people for some years, but does not seem to have met with any definite policy upon the part of our Federal Government. The agitation of this question has been brought forward principally in connection with the conservation movement, but to conform to the best ideas of conservation the development of water power should be hastened in every possible way and no obstacles placed in its course which will produce delay.

One of the main questions in contention seems to be as to whether the water rights and the land necessary for the development of power shall be turned entirely over to the corporations or persons proposing to carry on the development, or whether the use shall be permitted only under lease. A third possibility which does not seem to have been generally considered would be to permit the use of the water, title to which is retained by the Government, under a franchise similar to those used for the use of other public property, such as the streets and other highways. If an indeterminate franchise were issued to the corporation which develops the water power, the objections to a lease of limited duration would be removed, without legal title to the water being conferred upon any private party. To prevent undue exactions by such a corporation from the users of power, it would be necessary to establish control of the rates, service and issuing of securities in the same manner that this is now done by a number of states. By limiting the issuance of securities to actual cash sales with the proceeds applied to necessary developments, and with regulation of service and rates, there would not be the slightest danger of power consumers receiving unfair treatment. All such hydraulic developments should be limited to public-service corporations whose operations should come under the terms of a public-service law, such as referred to. In the case of companies transmitting power across the boundary lines of separate states, powers of regulation should come within the scope of the federal Interstate Commerce Commission.

One condition of granting any rights or franchises covering water powers should be that immediate development be carried out and no grants should be made under terms which would permit of speculative holding. Immediate de-

velopment of all water powers which are within an available range of power consumers is greatly to be desired and the first opportunity of using the power developed should naturally rest with those residing closest to the point of development. If the inhabitants of a territory in which power is developed receive the use of the same at the lowest cost for which such power can be developed and good service rendered, there is no reason why the Government should interpose any obstacles, even of the nature of exacting a rental or other form of payment by the operating company to the Federal Government. The property of operating companies should be taxed in the same manner as other similar properties within the state, but should be subject to no other tax.

Under an adequate scheme of regulation it is immaterial to the individual consumer, or to the public in general, who constitutes the active element in the promotion or management of such a corporation for public service. If the returns to the stockholders are limited to a fair interest upon the investment made, it makes no difference whatever who the individual stockholder supplying the capital may be. Attention has been called in the recent report of the Commissioner of Corporations dealing with this subject to the concentration of control of water-power developments in the hands of a few groups of financial interests. While such concentration, if entirely uncontrolled, might be used to oppress consumers, it is entirely unobjectionable when subjected to such restraints as above mentioned. Concentration of control is often economically advantageous, especially within a restricted area. The concentration of water-power control is probably due to very natural causes which have affected this form of development. One of these is that a comparatively small circle of banking houses have in the past been willing to handle the securities of this form of corporation. Another is the fact that the largest demand for power is from public-service corporations, and these have sought the development of water powers for their supply. Another element in producing concentration of control is the fact that the manufacturing companies have in many instances taken payment for apparatus in the form of the securities of the operating company, due to the fact that it has not been easy to sell these securities in the public market. There is no menace in the tendency, due to any one of these causes, to the general public interest, providing the Government keeps the regulation of this great public utility in its own hands.

MAKING A FAVORABLE IMPRESSION ON THE PUBLIC.

The good opinion of the public is one of the most valuable assets of almost any business concern. Speaking along this line before a gathering of electrical contractors not long ago, a man who ranks high among the successful ones in the profession emphasized two points especially. He insisted that the contractor should employ all reasonable means to make himself personally known in a favorable way to the other business men of his community; and, secondly, his business quarters should be such as to make a good impression on the prospective customer, and upon the public generally as well. As a concrete illustration of the value of this sort of thing, he spoke of the benefits which he felt sure had come to his own business from his affiliation with fraternal and commercial clubs in his town and from the fact that he had chosen for his store a location in the best part of the business section.

This matter is one which deserves more attention than it now receives. The public is quick to form opinions from appearances, and opinions thus formed concerning a business or its management count mightily toward its success or failure. Other things being equal, the business or professional man who cultivates the faculty of making himself personally widely known and popular has ten chances of success where the individual indifferent to such things has one. Moreover, the appearance of a man's place of business has much to do with the conclusions of the public as to whether the business is prospering or not, and the public quite generally abides by the principle that to him that hath shall be given. To legitimate prosperity it is usually willing to make further contributions.

Another matter to which electrical contractors sometimes fail to give the proper thought is that of the correct relations with employees. Honest dealing and reasonable wages are not sufficient here if other conditions exist which permit the employee to lack the proper interest in the welfare of his employer's business. The employee who likes and respects "the boss" is the best sort of advertising agent. The opposite attitude is always a serious handicap.

FREE INSPECTION.

It is customary in most municipalities to have a department, one of whose duties is to inspect all electric wiring installed in buildings and approve the same before the circuits are used for transmitting power. This inspection is in addition to that of the Board of Fire Underwriters, whose approval is necessary before a policy of fire insurance will be issued upon a building.

The theory of this inspection is to safeguard the lives and property of the citizens of a municipality, which may be placed in unnecessary hazard by fire or similar disaster arising from defective installations. The protection of every citizen against injurious acts or practices of his neighbor is one of the functions of the municipal government, and the electrical inspection service is carried out as one of the applications of this function. The service is primarily for the general public rather than for the owner of the premises inspected.

From these considerations it will be evident that

it is unreasonable to charge the owner of the premises with the cost of the inspection, although it is a general custom to do so. Since the service rendered is not for his own benefit so much as for that of others, there should be no charge for it. The burden of the cost should be met by those who receive the principal benefit, that is, by the general public, and the department should be supported out of the municipal treasury. This service is analogous to that of a health bureau and other departments whose aim is to further the general welfare.

PLACING MOTORS ON TRIAL.

The practice of making an installation of trial motors in an industrial establishment is a recent development in the commercial application of electrical power which signifies much in the way of improved accuracy of motor selection. Every power engineer realizes the importance of specifying the proper type and size of motor for every application, particularly in the plant of a newly acquired customer where the power salesman has made absolute statements and perhaps presented figures relative to the increased economy, efficiency and flexibility of motor drive.

Central stations and manufacturing companies have accumulated considerable data concerning the power requirements of all classes of machinery, but while this information is of course invaluable in estimating the probable motor requirements of a plant, it is the actual test in the shop which furnishes the final answer to the problem in any specific establishment. In addition, the placing of trial motors permits the most efficient and satisfactory arrangement of machines to be effected in advance of a permanent installation, leaves no question as to the motor rating for a given service and in the majority of cases indicates the relative merits of group and individual drive.

In some cases, particularly where a prospective customer desires a trial installation to be made before signing a contract for power, the cost of such an installation can be borne jointly by the customer and the central station. In other cases the relatively small cost of this service can be carried as a part of the cost of securing new business from power users. Under either method the practice is a good one.

SAFETY OF THE ELECTRIC MOTOR.

In advocating the use of the electric motor to replace other forms of mechanical drive, emphasis is usually laid upon the saving in cost of operation which will result, the greater output which may be realized, and the convenience of operation. Among the other incidental advantages which are secured by this form of installation, attention may be called to the greaer safety to employees.

Mounting the electric motor upon the frame of a machine, as it is done in the numerous instances of individual drive, does away with nearly all belting in the shop, which has long been a source of accident, with resulting injury to life and limb. This benefit is not attended by any corresponding disadvantage. In the present day, with statutory regulations holding employers responsible for accidents occurring in their shops, this consideration should carry some weight with the purchasers of motors and the engineers who decide upon shop installations.

Any condition which makes for more pleasant environment of a shop worker is likely to increase his working efficiency and consequently the output of the shop. One such condition is the reduced hazard of injury just mentioned and others are the less noise due to the absence of transmission machinery, the greater ease of control, and better lighting and ventilation, which are possible by clearing the overhead space of shafting and belts. Incidentally many little conveniences can be supplied in an electrified shop, such as lifting magnets, small hoists, etc., all of which not only help to save time, but make the work more pleasant.

All these little considerations carry some weight in the mind of the man who is considering the change to electric drive, but many of them are likely to be overlooked unless attention is particularly called to them.

A VITAL POINT IN MOTOR-VEHICLE APPLICATIONS.

Recent studies of the economy of motor-vehicles in commercial haulage have clearly established the fact that such equipment must be kept constantly on the move if its full benefit is to be gained by the owner. Central stations pushing the sale of the electric truck need to look to it to make sure that such machines will not spend any more time than is absolutely necessary standing still, for when this condition obtains, the cost of the service mounts up with extraordinary rapidity and not seldom tends to exceed the expense of horse deliveries on account of the increased charges on the investment applying to the motor-truck.

In a number of cases examined it was found that about two-thirds of the daily hours of service of a group of vehicles, representing the electric, gasoline and horse-drawn types, were passed under standstill conditions. Here is plainly a chance for the efficiency engineer to do some hard work. By the re-arrangement of routes, installation of tape recorders showing the performance of vehicles at all hours, and closer study of unit costs, much can be done to utilize each type of motor-vehicle to best advantage. There is a great deal of conservatism with respect to changes in delivery methods among long-time users of horse-drawn equipment, but it is only along this line that the ultimate economies of the electric truck can be fully realized. As soon as a merchant or factory owner can be made to realize that the electric truck offers him intensive transportation at a reduced unit cost, it will not be hard for him to break away from the rule-of-thumb stable practices which have so long dominated the field of merchandise haulage on roadways.

Direct, Indirect and Semi-Indirect Lighting Discussed at Pittsburgh.

At a meeting of the Pittsburgh Section of the Illuminating Engineering Society held on May 17, a symposium on direct, indirect and semi-indirect lighting was the main subject on the program. Contributed to this were three papers by Thos. W. Rolph, of the Holophane Company; J. G. Henninger, of the National Electric Lamp Association, and S. G. Hibben, of the Macbeth-Evans Glass Company.

Mr. Rolph's paper is a general discussion of the important engineering considerations of these three systems of lighting. He considers that the majority of lighting systems can be considered as made up of two parts, the direct and indirect components. The former is that portion of the illumination obtained from the light sources directly without reflection from walls or ceiling. The indirect component is that portion of the illumination produced by light reflected from the ceiling or walls, or both, before being received on the plane of illumination. Some systems have only one component, that is, they are either totally direct or totally indirect. The direct component is, of course, more efficient than the indirect.

Considering the advantages of a high indirect component Mr. Rolph points out that these are due chiefly to the high diffusion of the light. The principal advantages resulting are: low degree of specular reflection from surfaces worked on; absence of deep or sharply defined shadows; low candlepower and low intrinsic brilliancy of light-giving areas. Specular reflection from glazed or semi-glazed surfaces produces glare when the eye is in a position to receive the reflected light directly. This is particularly true from half-tone paper commonly used in magazines. It causes decided depression in visual function which means that the eye cannot distinguish details as well. The glare frequently is great enough to cause also decided discomfort to the eye. Respecting the shadow effects, Mr. Rolph contrasts shadows and shaded areas, the latter being defined as shadows with indiscernible edges. Shaded areas are always present. Shadows, however, may be entirely eliminated. Sharp shadows are very objectionable, while a shaded area of the same depth is not necessarily so. In drafting rooms shadowless illumination is ideal. Depression of visual function and ocular discomfort are present to a greater or less degree when a light source of high candlepower or high intrinsic brilliancy is in the field of vision.

The disadvantages of a high indirect component are: low efficiency and rapid depreciation due to dirt; light on the walls which may cause some depression of visual function; bright ceiling which may cause undesirable appearance; lack of perspective, due to absence of shadows. The first of these is the most important. By proper design, however, all the disadvantages of a high indirect component of illumination can be overcome to a large degree, except the disadvantage of low efficiency. The latter obviously in no way detracts from its desirable illuminating features, it merely makes them more expensive.

Mr. Rolph then discussed at some length the factors that affect the proportions of direct and indirect components. His conclusions in regard to this are that for the best degree of elimination of specular deflection on working surfaces the direct component should be but little greater than 12 per cent; for best shadow values it should be from 10 to 15 per cent; for best degree of eye protection it should be but little greater than 12 per cent. Departure from these values lessens the advantages of semi-indirect lighting. If the direct component is decreased below 10 per cent there is apt to be loss of perspective, and if it goes as low as zero undesirable contrast between the dark bowl and bright ceiling may be introduced. On the contrary, if the direct component is increased beyond 15 per cent the advantages of the indirect component are apt to be seriously reduced. For the probably great majority of installations the higher cost of indirect or semi-indirect lighting is not warranted on engineering grounds in Mr. Rolph's opinion. In some classes of service the high diffusion obtained is of sufficient value to warrant the increased cost.

Mr. Henninger's paper is devoted to tests and discussion of the comparative efficiencies of these three lighting systems. The first test involved a comparison of direct lighting with Holophane prismatic reflectors and indirect lighting with X-Ray reflectors, the same room, outlets and tungsten lamps being used; both clear and bowl-frosted lamps were tried for each system. The relative efficiencies, based on effective lumens in each case, were as follows: direct lighting (clear lamps) 100 per cent, (bowl-frosted) 88; indirect lighting (clear) 43.3, (frosted) 37.7. Another test showed the decrease in efficiency of indirect lighting when the walls are dark. A test of semi-indirect lighting in a barber shop where each fixture was equipped with an inverted translucent glass reflector and 1.875 watts per square foot was consumed showed 3.08 effective lumens per watt. Still other tests were made in a room equipped, first, with prismatic reflectors for direct lighting; second, the same reflectors inverted for semi-indirect lighting and, third, the second condition repeated but black cones hung about the reflectors to cut off all the direct light. The relative efficiencies in these three tests were 100, 50.6 and 33.75 per cent. Tests are also being conducted in a large office where many girls are employed at close visual work. With clear prismatic reflectors there was much complaint of eye strain, with the same reflectors inverted the results were splendid. These tests will be tried also with satin-finished prismatic reflectors.

Calling attention to the esthetic side of the question, Mr. Henninger points out the large field in decorative art open to indirect lighting. However, this system is not the panacea for every lighting ill. Semi-indirect lighting has its field, and so has direct lighting. It is true the fields of each overlap and, besides, personal tastes vary considerably. It is now universally agreed, however, that brilliant light sources must be kept out of the range of vision, that streaky illumination is dangerous, and good diffusion is of paramount importance.

Mr. Hibben's paper is a discussion of semi-indirect lighting as to distribution of illumination, relative cost, and decorative results and possibilities. Indirect lighting systems give much more uniform illumination than direct systems because the entire ceiling becomes a light source. Tests were made to verify this quantitatively. A four-light fixture was equipped with down-turned opal reflectors, then these were inverted, and finally opaque, black, conical shades applied to the latter to give pure indirect lighting. As regards distribution the indirect system gave most uniform results, the semi-indirect fairly uniform, and the direct system least uniform. In this semi-indirect equipment the ratio of direct to indirect component of light was about 1 to 2. Other tests were made to show the effect on distribution of using different glass hemispheres. Mr. Hibben believes that all the conditions prevailing must be carefully considered in deciding on the ratio of the direct and indirect components.

In the first tests referred to Mr. Hibben calculated the semi-indirect system to give 18.3 per cent less effective lumens than the direct system. He contends, however, that with the former there is much greater ease of vision, due to absence of high intrinsic brilliancy, and the pleasing appearance of the unit makes the entire visual apparatus operate at its best. As to decorative possibilities semi-indirect lighting has already shown in a modest way that it can be employed very successfully to produce results of great beauty respecting both the fixture itself and the making effective of the decorative features of the room.

Wireless Proposals at London Conference.

The American delegation to the International Conference on Wireless Telegraphy has extended an invitation to the congress to hold its next meeting in the United States.

It is stated that the Americans have been officially instructed to obtain the adoption of the following provisions:

All ships carrying more than 100 persons must maintain a continuous watch for calls made on standard wavelengths distinct from all other wavelengths.

The wave-length in commercial business to be increased from 400 to 800 meters.

Rigid restrictions against publicity in the case of intercepted personal and confidential messages.

Governments to be urged to insure the taking of regular meteorological observations on all ships, and their transmission to central stations in Europe and America, while storm warnings are to be redistributed to ships at sea.

Distress messages, weather observations, and storm warnings to take precedence over all commercial and private messages.

Provision to be made for a systematic inspection of the installation and operation of all radio apparatus, and the various radio systems must be forced to co-operate in sending distress, weather, and storm messages.

The necessity for the control of all radio communication under the Berlin Convention.

Stations to be provided for the different systems for exchange between the shore stations operating under the Berlin Convention.

Land lines to be carefully regulated.

The Americans are ready to make a strong fight for the adoption of the rule giving precedence to distress, weather, and storm messages, which is opposed by certain wireless interests.

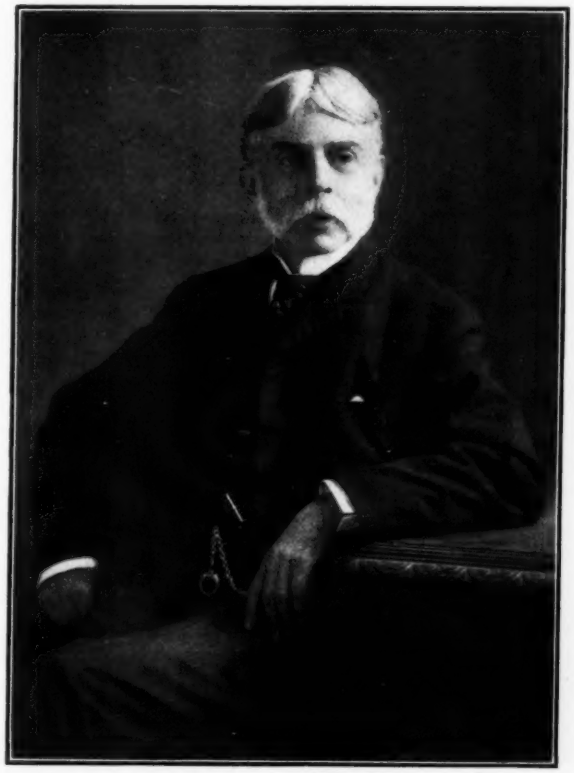
Wireless Station at Asbury Park.

The Marconi Wireless Telegraph Company of America has purchased 600 acres of land near Asbury Park for the erection of a wireless telegraph station, which will be its chief station in America. It is expected to carry on direct wireless communication with London.

It is also planned to erect a long-distance station at some point on the Pacific Coast.

George A. Hamilton.

George A. Hamilton, treasurer of the American Institute of Electrical Engineers since 1895, began his career in the electrical industry as a messenger in the telegraph service. He was in turn operator, chief operator, and manager from 1860 to 1871. From 1871 to 1873 he was employed in the railroad telegraph service, and from 1873 to 1875 was assistant to Prof. Moses G. Farmer. He assisted Professor Farmer in the design and construction of the early dynamos for lighting, blasting and electro-depositing. In 1875 and until 1889 he was in the telegraph service of the Western Union as electrician and engineer. In 1889 he became connected with the Western Electric Company.



George A. Hamilton,
Treasurer, American Institute of Electrical Engineers.

In 1876, with Garritt Smith, Mr. Hamilton introduced quadruplex telegraphy in England. In 1877, as chief electrician, he made the repairs to the Key West-Havana cables. He was the Western Electric Company's representative on the commission to France and England in 1899 to study the transmission properties of the then recently laid large-conductor underground cables.

Mr. Hamilton is a member of the American Institute of Electrical Engineers, serving as vice-president in 1884, 1885 and 1886, and of the French Physical Society. He is a foreign member of the British Illuminating Engineering Society, and a member of the Société Internationale des Electriciens.

Cedarmen Make Inspection Trip.

For the purpose of inspecting the white-cedar-producing territory of Northern Minnesota, and also to try their luck at catching the wall-eyed pike that abound in the lakes of this region, twenty-one members of the Northwestern Cedarmen's Association and a number of invited guests left Minneapolis on May 25, northward bound.

A special Pullman car was attached to the regular evening train on the Northern Pacific Railroad and transferred to the Minnesota & International, at Brainerd, Minn. The members of the party were President T. P. Bradley, of Duluth, Minn.; Vice-President W. C. Moss, of Minneapolis; Directors L. A. Page, of Minneapolis; J. W. Benham, of Chicago; and M. K. Bissell, of Escanaba, Mich.; Secretary H. H. McKinney, of Minneapolis; E. L. Clark, L. A. Furlong, H. F. Partridge, T. M. Partridge, M. H. Cooldige, M. H. Schussler and C. D. Wilkinson, Minneapolis; J. C. Kirkpatrick, Escanaba, Mich.; A. T. Naugle, R. H. Ross, R. W. Tansill and Harold Reade, Chicago; J. W. Naugle Bemidji; J. C. Sullivan, A. E. Witting, John Cann and Peter Oas, of Blackduck; S. C. Brown, of Big Falls, Minn.; F. V. Weisenberger, of St. Paul; and C. M. Mauseau, Rio de Janeiro, Brazil.

The morning of May 26 found the party at Blackduck, automobiles being in waiting to convey the party to the lake, where launches, boats and bait were ready for them. The special hosts at Blackduck were A. E. Witting and John Cann. The morning catch of pike surpassed the expectations of most of the visitors, who at noon adjourned to the lake farm of A. E. Witting, where a fish dinner was served, prepared by the ladies of Blackduck, with John Cann as chef and A. E. Witting, master of ceremonies. That the dinner was enjoyed was shown by the fact that Mr. Cann cooked 65 pike to appease the appetites of the visitors. In the evening the members of the party entertained the Blackduck hosts at a luncheon in the private car, ice cream, cake and coffee being served.

The second day was devoted to the

inspection of the cedar yards and operations north of Blackduck. A special engine and caboose, furnished by the Minnesota & International Railroad, were coupled to the Pullman car for the trip. Numerous stops were made along the route. The Mizpah yard of the T. M. Partridge Lumber Company, a model of its kind, was first visited. The next stop was at Gemmell, where the National Pole Company, of Escanaba, Mich., maintains the largest white-cedar yard in the United States. From Gemmell the party went to Big Falls for dinner and later the trip was continued to Little Fork, where the Bradley Timber & Railway Supply Company has made extensive improvements and installed a modern hoist, for taking the timber from the Little Fork River. While at Little Fork, the stock of the Koochiching Land & Timber Company was inspected. The party then returned to Blackduck and later left for Minneapolis.

The results of the trip were so satisfactory to all concerned, both from a business and recreation standpoint, that it is likely to become one of the annual affairs of the Association.

Land and Building Fund.

The following resolutions were adopted by the Board of Directors of the American Institute of Electrical Engineers on May 21, 1912:

WHEREAS direct official acknowledgment has not been made of all the contributions to the Land, Building and Endowment Fund of the Institute, and only a partial list of the contributors to the fund has been printed in the *Proceedings*, be it

RESOLVED that an alphabetical list of all contributors to the fund be printed in an early issue of the *Proceedings*, and be it

RESOLVED that the thanks of the Institute are hereby tendered to the contributors for enabling the American Institute of Electrical Engineers to comply with the terms of Mr. Carnegie's gift of the Engineering Societies Building, and be it further

RESOLVED that the thanks of the Institute are hereby tendered to the members of the Land, Building and Endowment Fund Committee, Messrs. Calvin W. Rice, chairman in 1904, and T. C. Martin, chairman in 1905 and 1906, and Messrs. John C. Barclay, U. N. Bethell, N. F. Brady, John J. Carty, Charles L. Edgar, Eugene Griffin, Samuel Insull, Francis W. Jones, John W. Lieb, Jr., J. H. McGraw, C. W. Price, Samuel Reber, Frank J. Sprague, Elihu Thomson and J. G. White, for the able and energetic manner in which they conducted the work confided to them, which resulted in securing contributions to the fund from 1,600 members, aggregating $170,000.

Convention of Railway Telegraph Superintendents.

The thirty-first annual convention of the Association of Railway Telegraph Superintendents was held at the Waldorf-Astoria Hotel, New York City, June 4 to 7. Some 275 members and guests were registered, the convention being the best attended that was ever held by the Association. Interspersed between the business meetings were a large number of entertainment features and inspections. Notable among these was the visit made to West Orange, N. J., to visit the Edison works as the guests of Mr. Edison.

Among the papers presented at the convention were the following: "Construction Material and Methods," by R. E. Chetwood; "Some Facts Regarding the Handling and Recording of Supplies," by W. G. Higgins; "Some Notes on Polarized Sounders in Telegraphy," by W. Maver, Jr.; "Use of the Main-Line Relay in Telephone-Selector Operation," by W. W. Ryder; "Telegraph Traffic," by W. V. Fashbaugh; "St. Louis Terminal Telegraph and Telephone Facilities," by F. E. Bentley; "What the Telephone Has Done for the Santa Fe Railroad," by L. M. Jones; "Maintenance of Telegraph Lines," by G. M. Yorke; "Use of Portable Telephones in Railroad Service," by J. F. Caskey; "Telegraph-Line Maintenance," by W. S. Melton.

The election of officers for the ensuing year resulted as follows: John B. Sheldon, Omaha, Neb., president; William Bennett, Chicago, first vice-president; A. B. Taylor, New York, second vice-president; P. W. Drew, Chicago, secretary-treasurer. Mr. Drew has held this position continuously since 1883.

It was decided to hold the next annual convention in St. Louis, Mo., in the week of May 12, 1913.

Wireless Bill Passes House.

The Alexander substitute for the Hitchcock bill, which recently passed the Senate, amending the Wireless Act of 1910 so as to take advantage of some of the lessons of the *Titanic* disaster, easily passed the House without amendment. As passed by the Senate the Hitchcock bill applied only to vessels carrying 100 or more passengers, and would not have affected cargo steamers.

So far as it relates to the steamers on the great lakes the Alexander bill would take effect April 1, 1913; as to cargo vessels on July 1, 1913, and as to other vessels on October 1, 1912. The demand on makers of wireless apparatus is so great, and would be increased to such an extent after the enactment of the proposed legislation, that the committee, recognizing the justice of the appeal for time in which to obtain the apparatus, fixed these dates later than was originally contemplated.

Under the terms of the bill it will be unlawful for steamers either of this or foreign countries navigating the ocean or the great lakes, when carrying fifty or more persons, passengers and crew, to leave an American port unless equipped with efficient radio apparatus, capable of transmitting messages at least 100 miles, day or night, under all conditions of atmospheric disturbance, when it is safe for the operator to work. The bill as passed by the Senate was applicable only to vessels carrying over 100 persons.

The bill also requires these steamers to have an auxiliary power supply, wholly independent of a vessel's main electric power plant, to enable the sending of messages for at least four hours over at least 100 miles, day or night. For vessels capable of sending only 100 miles, and most of them are in this class, four hours is the length of time in which a wrecked vessel would have to remain afloat while waiting for assisting vessels to arrive.

The present radio law requires only one operator on a vessel. The Alexander bill requires the radio equipment of each steamer subject to the act to be in charge of not less than two skilled operators, one or the other of whom must be on duty at all times while the vessel is being navigated. The bill would not apply to steamers plying only between ports less than 200 miles apart.

Electrical Exports for April.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has completed its monthly summary of the imports and exports of the United States for last April. From this source the following data relative to the electrical exports have been obtained.

The figures for April are disappointing in each class of electrical exports as compared with the corresponding month last year and as compared with the appliance shipments, at least, for the preceding month. The comparative monthly statement is as follows:

Month.	Electrical Appliances.	Electrical Machinery.	Total.
April, 1912....	$ 923,631	$820,385	$1,744,016
April, 1911....	1,064,562	888,283	1,952,845
March, 1912...	1,081,895	751,785	1,833,680

A list of the principal countries to which electrical shipments were made last April, together with the value of these exports, is given below:

Countries.	Electrical Appliances.	Electrical Machinery.
United Kingdom.....	$ 43,668	58,384
Canada	329,755	203,917
Mexico	127,464	57,034
Cuba	46,708	23,914
Brazil	137,465	179,784
Japan	82,817	172,363

Wireless communication has been established across the Andes Mountains in Peru between the cities of Lima and Iquitos without intermediate stations.

Electric Power in the Manufacture of Wooden Boxes.

The economy of space together with increased production and marked decrease in fire risk makes individual motor drive particularly adaptable for wooden-box factories. It is shown in this article that by properly conserving and selling the refuse an appreciable profit can be made by the purchase of central-station energy. Power data are given on six typical plants.

An analysis of conditions in plants devoted to the manufacture of wooden boxes indicates that, under present-day conditions, this industry offers an exceptionally profitable field for central-station energy. It is true that perhaps a majority of such plants still hold to antiquated methods of drive but this can only be due to lack of aggressiveness on the part of the central station.

There is no question as to the predominating advantages of electric drive for woodworking machines. It has been demonstrated under the severest service conditions that the electric motor renders possible the most economical approach to the direct application at the machine of the total initial power developed. Also, the better lighting and ventilation, the greater freedom from dust and lessened danger of physical injury, resulting from the removal of belts and shafting, have been found by experience to increase the productive efficiency of the employee. Electric drive minimizes the danger of accidents and by means of suitably located remote-controlled switches makes it possible to shut down the entire plant in case of emergency.

Motor Direct-Connected to Line Shaft in Box Factory.

Electric motor drive also permits of uninterrupted operation of the tool and the attainment of high shop time-factor; improved quality of product, as good product from woodworking machinery is largely dependent upon a drive capable of transmitting even and constant torque to the cutting tool; economizes unit cost of product, either by increasing product with a given equipment and personnel, or by direct economies in those charges debited exclusively to power; eliminates shafting and belting, allowing better placing of driven machines and reducing to a minimum the dissemination of sawdust and flying particles; permits the maximum return from those machines whose productive capacity is largely dependent upon the proper maintenance of speed and power, etc.

One of the principal advantages of electric power in box factories is the marked reduction in fire risk where central-station power is used. If power is obtained from an adjacent steam plant the fire risk is great and insurance rates correspondingly high. Mechanical drive necessitates either the dangerous proximity of the boiler room or heavy losses in long steam mains or rope transmission. If central-station power is used, all danger from adjoining power plant is removed; in any case, electric drive not only does away with the inflammable dust inevitably carried into the engine room by the large belt, but also makes possible the complete isolation of engine and boil-

er either by means of solid fireproof walls or by their installation in a separate building. The elimination of heavy line shafts greatly reduces the danger of fire from overheated journal boxes or from spontaneous combustion of accumulated oily waste or shavings. It should be remembered that the rate charged by insurance companies, especially where steam boilers are in close proximity to the working machines is exceedingly high, and that by installing complete electrical equipment in a modern fireproof building the annual premiums may be reduced from perhaps 7 to 8 per cent to three-quarters or one per cent. In many cases the savings in premiums will go far in making up for the original cost of the electric installation.

Wood Waste.

One of the large items of expense in any woodworking plant is that of power. However it is often erroneously assumed that its unit of cost is very low on account of the wood waste available for fuel, and that consequently there is not the necessity for such economy as is practised in other industries. However, actual experiences of numerous woodworking plants indicate that a ready market can be found for all waste and where the income from this is not sufficient to pay for the entire amount of power purchased from the central station it reduces power bills to such an extent that the cost of steam power, in comparison, is prohibitive.

No better example of the economy that can be effected by the use of central-station power and the sale of refuse can be given than the plant of the Lindermann Box & Veneer Company, Eau Claire, Wis. This company manufactures wood boxes principally and formerly used steam drive, the maximum output of the plant then being about 800,000 feet of lumber per month. In this plant there were five sets of saws and 90 men were employed. The company now purchases power from the Chippewa Valley Railway Light & Power Company, and the maximum output of the plant has been increased to 1,250,000 feet of lumber per month without any increase in labor. In the steam plant all shavings and blocks were burned, but under present conditions baled shavings are sold for $2.00 per ton. Each bale weighs from 75 to 90 pounds. The average monthly gross revenue from this business is $460, the net profit being not less than $300. This includes the cost of the services of a man to operate the baling press, depreciation and power for the outfit, which cost $300 including the motor. The Lindermann Company has a contract for its entire output of shavings, they being taken by a company that sells them as bedding for horses and cows.

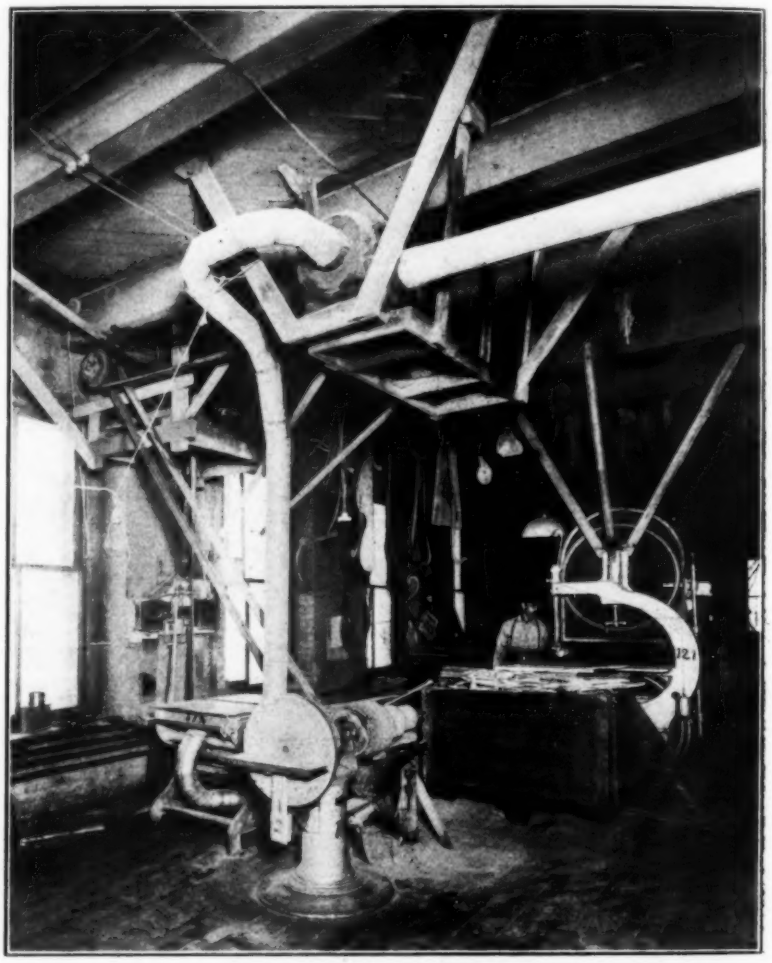
In addition to the income from shavings, the company secures $200 per month for sticks and shorts which are sold for kindling. This shows a total income from waste products of $500, and as the electric power bill averages $250 per month, a profit of $250 per month is realized. This record is not unusual in a plant using only soft wood. Complete information on the motor installation at this plant is given in the data sheet.

Selection of Motors.

The selection of the proper motors for driving woodworking machines used in box factories is of the utmost importance and should be given the proper consideration by power engineers. If only direct-current supply is available, motors should be compound wound or of the interpole variety, since it is absolutely essential that the motors be capable of resisting the inherently excessive peaks which are apt to occur during the all-day load of the great proportion of woodworking machinery. Direct-current motors should be totally inclosed, except in those special cases where the driving machines are ceiling-suspended away from shavings and sawdust or located in a separately partitioned room, in such a manner as to eliminate fire risk.

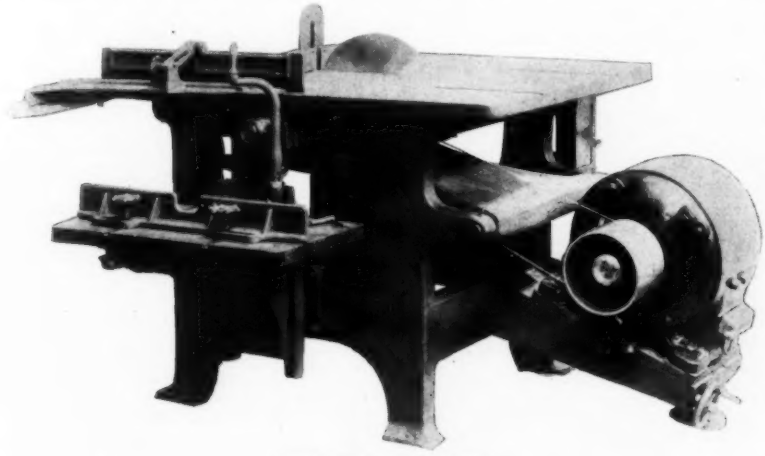
Large motors should be artificially ventilated and supplied with piping to and from outlet-openings (1.5 cubic feet of air per minute per horsepower is usually sufficient). All controlling appliances of whatever nature, if exposed to sawdust and shavings should be totally inclosed.

Where alternating-current supply is available, the polyphase induction motor with high-resistance squirrel-cage rotor should be specified, since the high-resistance rotor permits quick and frequent acceleration and provides the heavy starting torque required to overcome the inherently great inertia of woodworking machines. The type of alternating-current polyphase motors with polar-wound rotor and internal starting resistance, while possessing admirable torque and starting current characteristics, is not generally recommended for woodworking machines since sawdust almost invariably may be expected to collect on the starting resistance. In a few cases where variable speed with electrical control is desired, polar-wound internal-resistance rotors with collector rings and external resistances may be used. However, specifications should call for inclosed collector rings.



Motor Driving Saw and Blower.

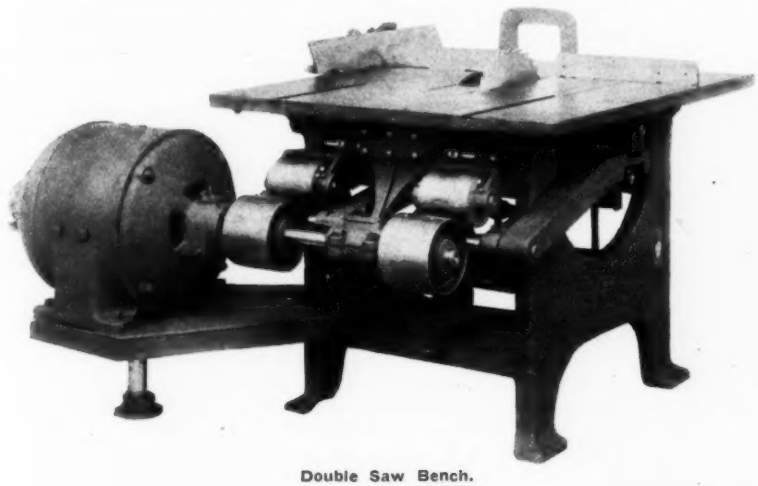
Since direct-current motors must be inclosed, their ratings for such operation must be sensibly diminished and larger machines are therefore demanded. In those few cases where variable speed is desired for operating the feed, alternating-current motors may be used of either the adjustable or multi-speed type. Woodworking plants are usually situated in the outskirts of the city, where the central station ordinarily supplies alternating current. The problem therefore, of supplying breakdown service is much simplified.



Combination Saw Bench.

Owing to the high speed and light moving parts of woodworking machines and the frequent violent application of the load, it is desirable to use belt drive rather than gears or chains, especially as the speed of the driven pulley is usually too high to permit of other than direct or belted connection. The direct drive is coming into vogue in many modern box factories and is giving excellent results where the motor has sufficiently generous rating to accelerate rapidly and to withstand overloads. As the average depreciation of belting averages 36 per cent per year, it is important to reduce this waste and furthermore do away with any source of slippage between the driving unit and the working pulley.

In the installation of motors in box factories, if belts are used, it is strongly recommended that the same do not run vertically or have so decided a vertical component as to minimize the arc of contact on the driving pulley and at the same time prevent the use of the belt-tension adjustment on the motor base. Motors may often be conveniently located in an inverted position beneath the floor bearing the machine. If this method is adopted the belt between the motor and the machine should be boxed in and the drive arranged, as above stated, at a sufficient angle to be able to make use of the belt-tightener arrangement. There is a wide opportunity for the solicitor or power engineer to use his ingenuity in the layout and novel methods of drive for box factories.



Double Saw Bench.

Improper mechanical connection between motor and machine or motor and countershaft has in some instances caused unjust criticism of motor drive. For direct connection a flexible coupling should be used unless motor and machine are mounted on a common metal bed plate or the motor is attached to the frame of the machine. Most manufacturers of modern woodworking machines have so designed them that they can be readily adapted to individual motor drive. Chain drive or heavy belt with a spring belt-tightener is desirable when the motor must be located close to the machine but cannot be direct connected. Fly-wheels should be used on motors driving machines which have only peak loads of short duration. With all belt drives a belt speed of from 4,000 to 5,000 feet per minute is most satisfactory and economical. Pulley ratios of more than five to one under ordinary conditions should be avoided when possible by using lower speed motors. When it is desired to install a motor on a machine having a speed several times greater than that of the motor, gear drives using steel-cut gears and rawhide or cloth pinions have been successfully employed.

Individual Blowers.

One of the most difficult loads for the central station to handle is that of the large exhaust blowers which are used to exhaust the refuse from the machines. Depending upon the size of the shop, one of these blowers may take from 20 to 150 horsepower, and the load is naturally constant throughout the working hours of the plant, therefore, the resultant bill if central-station energy is used, is liable to be a serious impediment to the customer's adoption of motor drive.

The marked economy of individual blowers, however, is becoming so well recognized that practically all new plants are being equipped in this manner. Some interesting notes on individual blowers were presented recently by S. A. Fletcher in the *Wood-Worker* from which the following is taken.

The great majority of shavings collectors have been installed with one large blower centrally located near the refuse bins. One or two main pipes, according as the single or double blower is used, are run through the shops, from which the branches and machine pipes are tapped off. The pipes are, if properly installed, proportioned so that the total area of the branches equals, or at most is only very slightly larger than, the area of the main. Thus a 30-inch main could have 25 six-inch branches and the area of the main would equal the area of the branches, as the areas are proportional to the squares of the diameters. Gates or dampers may or may not be supplied at each opening. In any event, the blower must run all the time, exhausting air from each of the pipes, ready to carry off refuse from any and all openings, and as much power is consumed when merely moving the air as when carrying a full

load of refuse. The blower runs at least eight hours a day, in spite of the fact that each opening will not average two hours a day actually collecting refuse, and the vacuum is maintained the remaining six hours without doing any real good.

Because these blower systems were at first driven from the lineshafting and were but small, as compared to the total installation, the amount of power used by the system was not made particularly prominent. The mechanical drive system already had a large continuous load, due to the friction of the belts, the lineshafts and the jackshafts, so that the blower load added made but little apparent increase; but, of course, it ate into the fuel pile just as much as though it had been known. When electric motors were applied to the woodworking blower systems, the facts soon became evident, because the motor afforded a very ready means of making a test of the power consumption. Not only was it very evident that the motor was of fair size, but it ran well loaded the entire operating day. In fact, it has been not infrequently found that a three-horsepower motor driving a blower consumed one-third the total power used in a plant with 30-horsepower installed. In other words, the blower used half as much as all the other machines. This is due both to the continuous operation of the three-horsepower motor and to the very short time of operation of all the other motors.

Actual tests on well equipped blower systems have shown that the power consumption is not greatly reduced by closing the gates on all the idle machines. In fact, one test made on a system with over 25 openings showed that with but one damper open and all the others closed, the power was reduced to 60 per cent of the full load. Opening five gates gave very nearly as much load on the motor as opening them all. This shows that while it is highly desirable to have gates, in order to maintain a good vacuum on those openings which are actually collecting refuse, very little reduction in power may be effected even by prompt closing of the gate on every idle machine. It further tends to show that the pipes are in general somewhat larger than necessary, and hence that larger blowers have been used than were actually needed. But as it is necessary to provide for the maximum conditions which may occasionally occur, all the machines operating at the same time, it is difficult, if not impossible, to arrange for much improvement without a complete revision of the system.

But the result of this increased information gained by the application of individual motors to the blowers, has been a recent extension of the individual system to the blowers themselves. Instead of one large blower piped to all of the machines, a number of small blowers may be installed to serve individual machines. Each blower is either belted from the main motor which drives the machine, or it may be operated by an independent small motor, so connected as to start and stop with the main motor. Of course, this system will require slightly more investment in blowers, and in some instances possibly a trifle more in the piping system, for separate pipes must, of course, be run from each blower direct to the refuse bins. Or several pipes may be run to one main which itself is connected to a blower, which prevents clogging of the system where blowers are idle. Also, there may be in some instances some extra cost in the motors. However, the greater investment charges will not be sufficient to affect the real economy in the operating cost. The blowers run only when actually required to move refuse, and hence shutting down a machine stops the power consumption, not only of the machine, but also of the vacuum for that machine.

This individual system will be found most economical in such shops as of necessity have an intermittent load. Where a complete routine has been possible, and the great majority of the machines are actually running six or eight hours each day in the week, the individual blower system will not show any decided economy over the group system, and may even be less efficient; but in all mills where the work is largely of a jobbing nature and most of the machines are shut down more than they are running, taking the entire year as the basis the group system will be found less economical than the individual.

It is practically impossible to give actual figures which show the difference made by the use of two blower systems for practically no plant is changed from the group system to the individual system without also making some other change which would affect the power consumption, thereby removing the possibility of making a satisfactory comparison. But it is safe to say that in the great majority of plants, where the load-factor is considerably below 25 per cent, the saving in power due to the individual blower system will be at least a third, and more probably a half, of the load required by the group blower. It is usually customary to equip only those machines with individual exhaust which produce a reasonable amount of refuse, and not provide a blower for each and every machine. This requires a few minutes a day in sweeping around each small machine, but further helps to keep down expense.

Motor Direct-Connected to Shaper.

Power Requirements.

The power required to drive woodworking machinery varies widely according to the hardness and relative humidity of the wood used, the speed and depth of cut, the physical condition of the knives, saw teeth or other cutting tools. New and stiff machines, such as triple-drum sanders may take considerable more power at first than after a few weeks' limbering up, and dull or wrongly adjusted knives may result in a drain of 200 to 300 per cent on the power source over what would be required if the machine were in good order.

Complete information relative to the power required to drive woodworking machines was given in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for April 6, 1912, on pages 651 and 652.

Wooden-Box Manufacture—Data Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

A. O. Fisher, Chicago, Ill. This plant specializes in cigar-box manufacture but manufactures a few styles of larger boxes. Combination drive. Running hours per week, 50 to 55.

Total connected horsepower, 35.5. Total number of motors installed, 22. Average kilowatt-hours per month, 1,791. Average kilowatt-hours per month, per connected horsepower, 50.7.

Kilowatt-hour consumption for 12 months: January, 1,500; February, 1,218; March, 1,647; April, 1,793; May, 1,665; June, 1,706; July, 1,681; August, 1,716; September, 1,744; October, 2,332; November, 2,441; December, 2,047.

Average load-factor, 9.3 per cent. Maximum demand, 8.5 kilowatts.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts direct current.

No.	Horsepower.	Application.
4	0.25	Each direct-connected to an 8 by 10-inch Gordon press.
3	0.5	Each direct-connected to an 8 by 16-inch Gordon press.
1	0.5	Driving a line shaft to which are connected two nailing machines and one 18-inch grindstone.
1	0.5	Belted to a line shaft driving two nailing machines and one box trimmer. (The trimmer is a small milling machine with a 0.25-inch wide disk milling cutter.)
6	1	Each direct-connected to a circular disk saw.
1	2	Direct-connected to a jointer for cigar-box wood, 0.25-inch thick.
1	2	Direct-connected to a 48-inch paper cutter.
1	3	Driving line shaft to which are connected one 10-inch cylinder sander; one 18-inch surface sander; and three box trimmers.
1	3	Driving line shaft to which are connected two 12-inch disk rip saws.
1	5	Belted to one exhaust fan for exhausting shavings and sawdust.
1	10	Direct-connected to freight-elevator mechanism.
1	1	Direct-connected to fire pump.

Energy for this installation is supplied by the Commonwealth Edison Company.

Letts Box Company, Oklahoma City, Okla. Manufacturer of wooden boxes. Group drive. Running hours per week, 60.

Total connected horsepower, 10. Total number of motors installed, 2. Average kilowatt-hours per month, 290. Average kilowatt-hours per month, per horsepower connected, 29.

Kilowatt-hour consumption for 12 months: January, 340; February, 338; March, 240; April, 252; May, 297; June, 296; July, 239; August, 186; September, 378; October, 309; November, 352; December, 259.

Load-factor, 6 per cent; operating-time load-factor, 14.8 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, three-phase, 60 cycles.

No.	Horsepower.	Speed R. P. M.	Application.
1	5	1,800	Belted to a countershaft to which are connected two 16-inch cut-off saws.
1	5	1,800	Belted to a line shaft to which are connected one 26-inch single surfacer and one automatic nailing machine.

This motor installation replaced a steam equipment where shavings were formerly used for fuel. Energy is supplied by the Oklahoma Gas & Electric Company.

Box factory, name withheld, manufacturing packing boxes of all sizes. The capacity of the equipment is 50,000 feet of lumber per month, while the average monthly output is 15,000 feet. Combination drive. Running hours per week, 60.

Total connected horsepower, 39. Motors installed, 10. Average kilowatt-hours per month, 308.

Kilowatt-hour consumption for 12 months: January, 390; February, 500; March, 330; April, 260; May, 360; June, 380; July, 310; August, 230; September, 260; October, 150; November, 250; December, 280.

Load-factor, 1.4 per cent; operating-time load-factor, 4 per cent.

The approximate total electrical energy consumption per 1,000 feet of lumber worked is 20 kilowatt-hours.

MOTOR INSTALLATION.

The following motors are of the squirrel-cage type, two-phase, 60 cycles, 220 volts.

No.	Horsepower.	Speed R. P. M.	Application.
1	2	1,120	Belted to Crescent 36-inch band saw.
1	3	1,700	Belted to countershaft of a Rowley & Hermance single-spindle shaper.
1	3	1,700	Belted to countershaft of 16-inch swing cut-off saw.
1	3	1,700	Belted to 12-inch jointer.
1	7.5	1,700	Belted to countershaft of 9-inch four-side molder.
1	5	1,700	Belted to 12-inch rip saw.
1	7.5	1,120	Belted to J. A. Fay 24-inch single surfacer.
1	2	1,700	Belted to 12-inch cut-off saw.
1	3	1,700	Belted to 10-foot line shaft (four hangers) driving one four-head tenoner and one 8-inch drill.
1	3	1,700	Belted to 10-foot, three-hanger, line shaft driving one 36-inch grindstone; one jig saw and one 10-inch double emery wheel.

Wooden-Box Manufacture—Data Sheet No. 2.

Lindermann Box & Veneer Company, Eau Claire, Wis. Box manufacturer. About 1,200,000 feet of lumber are handled per month. Combination drive.

Total connected horsepower, 230. Total number of motors installed, 24. Average kilowatt-hours per month, 21,005.

Load-factor, 17 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	20	1,800	Direct-connected to one American No. 6½ 27-inch double surfacer.
1	20	1,200	Direct-connected to one American No. 6½ 27-inch double surfacer.
2	7.5	1,800	Each direct-connected to a 24-inch American box-board machine.
2	10	1,800	Each belted direct to a six-inch Moreen Johnson Ferris wheel trimmer. Motor pulley 11 inches by 8 inches.
1	25	1,200	Belted direct to a 50-inch Moreen Johnson horizontal band resaw.
1	5	1,200	Belted direct to a Moreen Johnson squeezer.
1	25	1,200	Belted direct to a McDonough Manufacturing Company 54-inch band resaw.
1	3	1,800	Belted direct to a Moreen Johnson 14-inch rip saw.
6	5	1,800	Each belted direct to a Beech 14-inch cut-off saw.
1	3	1,200	Direct-connected to a No. 4 Doig nailing machine.
1	7.5	1,800	Belted direct to one American Universal saw.
1	5	1,800	Belted direct to a Hooper two-color printing press.
1	5	1,800	Belted direct to one American No. 11 combination saw and dado machine.
1	5	1,800	Belted direct to one hand-hole machine.
1	5	1,800	Belted to a line shaft driving one automatic circular-saw grinder; one automatic band-saw grinder; one automatic knife grinder; one hack saw; one small drill press; one small lathe; one small air pump; and one pair of six-inch emery wheels.
1	35	514	Direct-connected to an 80-inch Sturtevant blower.

Energy for this installation is supplied by the Chippewa Valley Railway, Light & Power Company, Eau Claire, Wis.

Box factory, name withheld, manufacturing wire-bound boxes for shipping merchandise. The corner posts are made at this plant but the thin side boards are sawed from purchased dressed material. The monthly output is equivalent to 17,000 boxes. Group drive. Running hours per week, 60.

Total connected horsepower, 21. Total number of motors installed, 4. Average kilowatt-hours per month, 1,190.

Kilowatt-hour consumption for 11 months: February, 1,299; March, 1,464; April, 1,056; May, 1,076; June, 955; July, 968; August, 977; September, 1,610; October, 1,190; November, 1,245; December, 1,268.

Load-factor, 10.4 per cent; operating-time load-factor, 28.6 per cent.

The electrical energy consumption per 1,000 boxes manufactured is 70 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	10	1,700	Belted to a 30-foot shaft (five hangers) and 14 feet of countershafting (six hangers) driving one B. G. Luther & Company gang rip saw, three 9-inch saws, four feed rolls, 36 inches long; one J. A. Fay & Company 14-inch rip saw; and one Luther gang cut-off saw, three 14-inch saws.
1	5	1,700	Belted to a 40-foot shaft (five hangers) driving two end-stapling machines, two feet and four feet box capacities respectively; one National Wire Bound Box Company special dado; and one F. X. Hooper two-cylinder box printing machine, 18-inch pulley, 290 revolutions per minute, maximum box 20 by 48 inches.
2	3	1,700	Each back geared to a National Wire Bound Box Company box blank machine, capacity 50 inches wide.

A small low-pressure boiler is installed for heating the buildings and operating a dry kiln.

Small combination box factory and planing mill. Group drive. Running hours per week, 60.

Total connected horsepower, 12.5. Number of motors installed, 2. Average kilowatt-hours per month, 357.

Kilowatt-hour consumption for 12 months: January, 400; February, 440; March, 370; April, 380; May, 270; June, 290; July, 270; August, 300; September, 340; October, 330; November, 280; December, 320.

Load-factor, 5.4 per cent; operating-time load-factor, 14 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed in this plant. The supply source is three-phase, 220 volts, 60 cycles.

No.	Horse-power.	Speed R. P. M.	Application.
1	7.5	1,700	Belted to a 12-foot shaft (three hangers) driving one Smith 36-inch band saw; one 10-inch bench rip saw; one combination saw and dado (12-inch saw) and one Porter 12-inch jointer.
1	5	1,700	Belted to a 20-foot shaft (six hangers) driving one 8-inch diameter post sander; one hollow chisel mortiser and one vertical boring machine.

Commercial Practice
Management, Rates, New Business

A PLAN FOR INCREASING THE POWER LOAD.[1]

By H. W. Cope.

The central station is a producer of electrical energy; the maker of electrical apparatus is a producer of devices utilized in that industry. Both are manufacturers having many problems in common which can be solved in an identical manner or along lines the fundamental underlying principles of which are the same. The consumer is the third party in whom both these manufacturers have a common interest, the central station in the sale of power, the maker of apparatus in the sale of his product. It is the purpose of this paper to consider some of the problems of the central station from its position as a manufacturer, and later to study their solution from the same point of view.

"Reduce the manufacturing costs" is the watch-word of the manager of every manufacturing industry, whether engaged in making cloth, shoes, electric power or anything else. This may be done in several ways, which are fundamentally but two: either stop wastes in the manufacturing process itself, or increase the output so as to decrease the fixed cost per unit. This latter method affords great opportunities for reduction in manufacturing costs. Every industrial manufacturer has recognized the fact that in case his output drops below some pre-determined value, practically all of his profits will be absorbed in manufacturing costs, while each central station has found that its load-factor must be above a certain figure or it will lose money. There is, however, this difference between the two cases: The manufacturer must continually be securing new orders and new customers to maintain the amount of his total sales, while the central station, after securing a customer, barring accident, enjoys a continuous revenue over an indefinite period of years, and can devote its energy to other prospects, practically no effort being required so far as the old customer is concerned.

The cost of producing power in a central station varies from hour to hour according to the load, because of the varying efficiency of the station equipment under different loadings and because of the variation in the fixed charges with the different loadings. Fig. 1 shows the curves of load and cost per kilowatt-hour for a period of 24 hours for a typical lighting station with a lighting load only, plotted hour by hour. The fuel and labor charges are in inverse ratio to the load. The interest and depreciation charges on the other hand are in proportion to the load. This is due to the method of charging, which is as follows: Each kilowatt of capacity involves a certain investment, and consequently the fixed charges for each should be paid by the energy delivered by each; that is, each portion of the equipment should bear its own fixed charges. It is evident that certain portions of the equipment are in service 24 hours a day and other portions less than two hours a day, hence the fixed charge per kilowatt-hour for the power used 24 hours is just one-twelfth of that for the power which is used two hours a day. For each hour the fixed charge per kilowatt-hour is dependent upon the length of time the equipment is in service. This curve shows when power can be sold at a low rate and how low a rate can be given for each class of load. It is also apparent that the actual hourly cost varies widely from the average cost taken through the entire day.

Fig. 2 gives the increase in the use

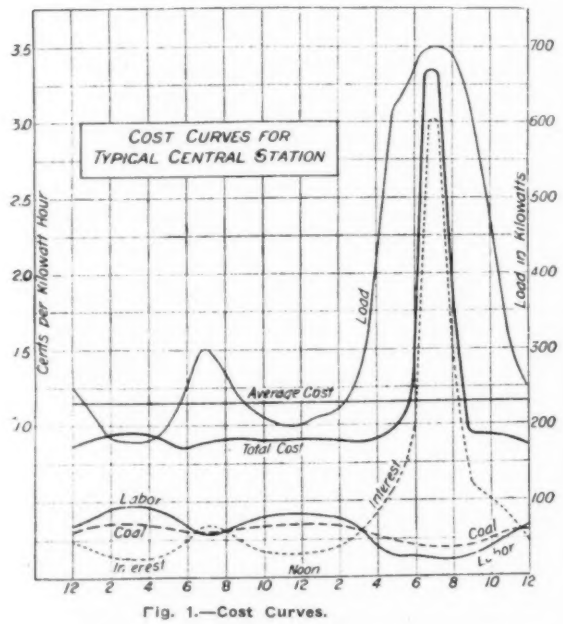


Fig. 1.—Cost Curves.

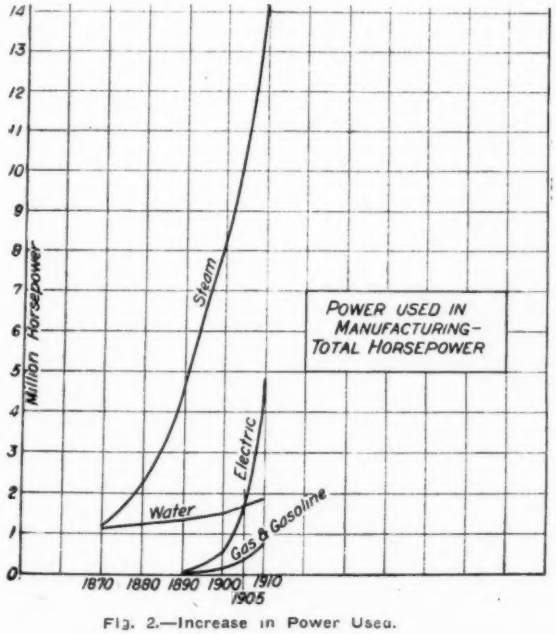


Fig. 2.—Increase in Power Used.

[1] A paper presented at the Seattle Convention of the National Electric Light Association.

of power for manufacturing in the United States since 1870, as compiled from the Census Bulletins, and shows the total actual horsepower installed in the four main forms of power, namely, steam, water, gas and electricity. Fig. 3 shows these curves plotted in percentages of the total. The predominance of steam is very marked in both of these curves, but Fig. 3 shows very clearly that steam power has reached its maximum percentage and is rapidly falling off, while electricity is increasing with tremendous rapidity, especially within the last five years. Still, in 1909, but 22 per cent of the power used in the whole country was electrical power and but 36 per cent of this, or about 8 per cent of the total power, was supplied from the central stations. The field for the central station is, therefore, very far from the saturation point, and the opportunities for the future are almost unlimited, every one of these power-users being a prospect for electrical power. It will be observed from this curve that, especially in recent years, the central stations generally have been educating power-users in the advantages of electricity and that sentiment is growing in its favor. Motor manufacturers are increasing this sentiment by their advertising and by the efforts of their sales engineers, and as the sentiment is cumulative, one good installation influencing another through the medium of the industry itself, the future use of electrical power will show even more rapid progress.

Increasing knowledge of the advantages of electric power will inevitably, in time, result in the complete electrification of practically every industry in the country, since it must be conceded that electricity is the best known form of applied power. There will of necessity be competition between the two sources of supply, the isolated plant and the central station, unless the central station is in the forefront leading the movement. This means an aggressive, systematic working of the field.

The field of each central station has a well-defined limit, depending on transmission, and includes every user of power located within the territory now served or to be served by the central-station circuits. The central station is of necessity as much of a neighborhood proposition as, for instance, a baker. It is of no importance what the field may be in the next town or state, its products can be sold only to the people in the community, and that field should be developed to the utmost.

Too often the central station has unconsciously classed itself with manufacturers who make a national product for sale in a national market, for example, automobile manufacturers who conduct broad sales campaigns, hitting many places where no sales are possible, taking the bad with the good, and thereby obtaining a satisfactory volume of sales without developing the highest density of business in any locality. Such a campaign is necessarily the only one which a manufacturer of national scope can adopt, but it does not under the most favorable conditions secure the business which may be obtained by the real combing of a local field. The automobile manufacturer shoots with a shotgun at a flock of birds, hoping to bring down one, or at best two of them, with a very small percentage of the total charge; the central station should do its shooting with a rifle and make every shot hit the mark. The central station, then, must make a systematic campaign which will secure business by convincing each and every user of power that electric power is the best for him, and then by proving that it is better to purchase power than to produce it on the premises.

A proper plan of campaign is the first essential to insure success. Without a suitable plan some success may be attained, but there is no possibility of securing maximum results without a comprehensive method of attack followed by consistent effort in carrying it out. It is the writer's belief that the scheme set forth herewith contains the fundamental elements to make it the most effective plan that has ever been carried out. While it is outlined with special reference to large central stations covering a broad area and many classes of industries, it is equally well adapted to the smaller stations which are more restricted in their operations, both by reason of limited field and fewer solicitors and engineers.

Except as the economical layout of transmission circuits may slightly alter it, the plan of the campaign is to secure information on every power user in the territory allotted to the central station; to classify the users by industries; and then to concentrate on one industry at a time, cleaning up each before going on to the next.

First, then, a house-to-house canvass must be made to secure a complete list of prospects for all industries with the following information on each prospect:

1. Class of manufacturing.
2. Approximate connected horsepower.
3. Approximate maximum demand, and time of occurrence.
4. Approximate average demand.
5. Approximate load-factor.
6. Approximate period of operation.
7. Estimate of present factory output.
8. Estimate of present power costs.

When this information has been secured the names of the prospects are to be brought together under their respective industries, then these industries are to be grouped in three classes, each class having the same general effect upon the central-station load. The effect on the station load may be determined from the time of the maximum load, the approximate period of operation and the load-factor.

First, there are those which will derive the greatest benefit from the use of electric power because of their low load-factor and consequent high investment charge per unit of power consumption. In this class are machine shops, planning mills, blacksmith shops, small foundries, printing plants, small manufacturing concerns and many other miscellaneous users of power.

The second class consists of power users whose demand is nearly constant throughout the working day, but whose manufacturing conditions, such as scattered location of buildings and heavy machinery consuming much power, demand an economical method of distribution. Such industries as pipe foundries, textile mills, brick plants, potteries and breweries belong to the second class.

The third class is made up of the power user whose work either requires practically no attendance, and can, therefore, be performed after midnight and before the day load proper begins, or whose manufacturing process is continuous except for the few hours during the peak. Municipal water-pumping plants, ice plants, cement plants, paper mills and others are included in this class.

As the first class will ordinarily receive the greatest direct benefit by using central-station power, they will be the most enthusiastic boosters for purchased power and should, therefore, be worked on first. The additional business secured will also lower the cost of production, and because of the double benefits derived the central station will then be in a still better position to take care of the second and third classes. The prospects in each class are to be worked upon, industry by industry, each solicitor handling one industry at a time; for example, all the printers will be thoroughly canvassed, layous made, motors specified, contracts signed and the trade cleaned up before progressing to the next industry, which will then be taken up in the same manner and completed before the third is touched. When the first class is completed the second class may be attacked and then the third.

This campaign by industries is unlike the usual geographical campaign with its allotment of specific territories to each solicitor, and has many fundamental advantages not to be found in any other plan. Information regarding every prospect must be secured at some time, and obviously this can be accomplished with a minimum expenditure of

time and money if done all at once instead of extending it over a period of several years, and it affords the manager of the new-business department a birds-eye view of his entire problem which is invaluable in commencing a systematic campaign. It makes it possible to work first upon those prospects which will on the whole be most profitable. It affords the best means of gathering complete data on each industry from the many available sources, the National Electric Light Association, the magazines and the motor manufacturers. Much reliable information may be had as to what other central stations have done in the same industries, the rates they have made, their power consumption per unit of manufactured product and the economies which have resulted, furthermore, after compiling complete data, which have enabled the solicitors to start actual work in the field, the desired information from outside sources for the remaining industries should be put under process of collecting in the order of the campaign program, so that it will be in readiness for the solicitors when the succeeding industries are attacked, thus insuring against loss of time on the part of solicitors.

From the complete data it is possible to decide better what rate should be given to each industry and better to anticipate the results.

Better results will be secured by the solicitor. Laying out work in this manner is like setting a rate in a machine shop—it sets a "bogey" to which the men are to work. It inevitably results in a more efficient organization. The solicitor approaches his prospect armed with all the facts. As he works day by day on the one class of customers he, of necessity, becomes familiar with manufacturing processes and is increasingly fitted to analyze requirements and to recommend equipments which will give the maximum of efficiency and the most satisfactory operating service. He really masters the situation, whereas, when he jumps from one industry in the morning to a totally different one in the afternoon, and so on, continually changing, he inevitably becomes superficial and fails to grasp the essentials for a comprehensive, high-grade layout. After a solicitor has thoroughly analyzed one industry from the ground up so that he not only understands the problems in detail but has solved all of them, he is in much better shape to take hold of another and handle it in the same efficient manner. Because of his success, he will gain increased confidence in himself; confidence backed by a thorough knowledge of his subject will lead to higher accomplishments; it will be cumulative, and not only greater returns will result to the central station, but the solicitor himself will be more contented because of it.

In working by industries, great benefit can be derived from the direct assistance of motor manufacturers whose engineers are necessarily specialists in various industries, and consequently are more willing and able to render assistance to the central station in securing customers when they can work on, say 25 prospects in one industry instead of as many prospects in 25 different industries. In addition, the solicitor becomes an expert, with real ability to grasp the fundamentals of the manufacturing requirements and to fully understand their best solution.

The prospect will be handled to better advantage. He will respond more readily to the arguments of solicitors who are able to talk to him intelligently, about the running of his business, and confidence will be established at the start. One good installation

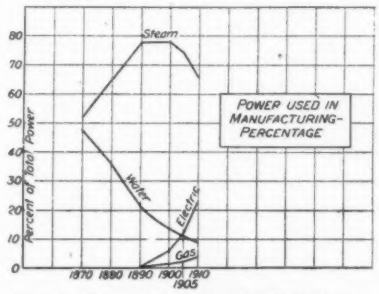


Fig. 3.—Power Used in Manufacturing.

leads to another, hence it is well to sign up the leaders first. Manufacturers will not be slow to electrify their plants when once convinced that by so doing they can reduce their manufacturing costs. Orders will result from any well-conducted campaign, but will be more readily given when the example is set by other manufacturers engaged in the same industry. When a prospect comes to realize that the local central station is interested in securing increased efficiency for him and actually has the ability to analyze his own peculiar requirements and to make recommendations which will save money, the business is as good as secured. Under the influence of an aroused and interested industry, a certain number of orders fall in without especial effort on the part of any one. The rates becomes a less important consideration in the prospect's mind.

In this connection, it may be stated that it is advisable to tabulate the results which have been secured by the prospect with his original equipment and the results he will obtain by the proposed change, placing them in a prominent place, preferably on the first page of a more detailed report. This report left with the prospect for his careful consideration acts as a silent salesman which is frequently more convincing than the personal appeals of the solicitor and permits the prospect to persuade himself to become a purchaser of power.

This plan lends itself admirably to the practice of efficiency engineering in building up the power load; in fact, it leads directly into efficiency engineering, which is a most important factor in a successful power campaign. While every ambitious solicitor will himself become an efficiency engineer in some degree, the larger central stations may find it profitable to select one or more men who can specialize in it, or can retain an outside engineer to investigate the more important installations, and recommend improvements in the layout of the machines, the routing of the work, the speed of operation of the machines, and other points which will improve manufacturing conditions. In many cases the motor manufacturer will be able to do a large part of this engineering, or at least to check the work of the solicitors and make such suggestions as may be required, although an outside engineer who is paid a retaining fee can, of course, devote more time to a given installation. As the efficiency engineer necessarily works by industries, it will be further apparent that the central station which concentrates upon one industry at a time can most readily secure his services and get the most from him.

The growth of our manufacturing industries in the past half century has been so enormous and our country's resources are so great that much more attention has been given to the volume of production than to the efficiency of production. It has been necessary to get the work out without regard to close economy, and demand has been so great that prices have been high enough to allow good profits. There are many economies practiced in the manufacturing industries of Europe that are unknown here, but with increased competition manufacturers are finding it more and more necessary to adopt means to stop the leaks which they know exist in their manufacturing. These leaks may be due to various causes: poor processes of manufacture, machinery or labor, poor supervision, power or handling of material. Many of them cannot be traced by the regular shop employees, superintendents or even the manager, largely because of their close proximity to the trouble, which prevents its solution in the large. The efficiency engineer coming in from outside with his experience in other places and his investigating mind, is able very speedily to recommend changes, one here and another there, which result in stopping numerous wastes with a resultant economy that makes the difference between profit and loss.

In the overloaded plant the efficiency engineer devotes his time to increasing the output of the machines already installed, to the proper routing of material through the shop, to the arrangement of the machines in logical manufacturing sequence so that the material is delivered on the proper side for the most efficient handling between machines. His object is to increase the factory output, and he ordinarily finds that a slight regrouping of the machines will effect a material saving. This regrouping usually involves individual motor drive, so that efficiency engineers in general use electric drive as a means of effecting an economy and not because they consider it a panacea for all manufacturing ills.

In plants which are running below full capacity, the efficiency engineer strives for economies in production, savings in handling, and at other points along the line, with the object of reducing the cost of production per unit rather than of increasing the output from the factory. In both cases the methods are practically identical, but different results are sought.

The conditions which an efficiency engineer found in one mechanically driven bolt and nut factory crowded with orders, and the results secured by his work show the method of attacking such problems. In one department of this factory a row of machines was driven from a long line shaft running the length of the shop, with the machines located to suit the line shaft. It was found that by placing the machines at right angles to their original position and substituting individual drive, the number of machines could be increased 25 per cent, and the amount of labor necessary for handling material reduced 50 per cent. The elimination of the line shafting made it possible to use overhead cranes and the routing of material was more direct. All other features were carefully analyzed and further changes made which resulted in the adoption of combined group and individual motor drive and the complete electrification of the factory; the total net gain in production amounting to 25 per cent without the addition of a single machine to the factory equipment.

Another investigation was made, at the request of a railroad, into the operation of its repair shop. The equipment comprised a central high-pressure boiler plant which supplied steam to several points in the shops, approximately 70 per cent being used for steam hammers, air compressors, pumps and heating; the outlook for electrical power was, therefore, very discouraging, but a complete analysis disclosed some very surprising facts.

Two systems were considered: (1) The use of central-station power with motor drive. (2) The replacement of the steam engines by steam-turbine units and motor drive. The complete operating expense of the original installation was known accurately and a comparison of the two proposed systems was made as tabulated herewith.

	Present Equipment	With Turbine Equipment	Purchasing Central-Station Power
Steam for hammers, air compressors, pumps, heating, etc.—			
Coal	$10,972	$10,972	$10,972
Water	253	253	253
Labor	5,156	5,156	5,156
Light and power—			
Coal	4,937	1,435	.....
Water	110	32	.....
Oil, sundries, etc.	1,200	1,200	.....
Engineer electrician	2,348	2,348	2,348
Lamp trimmer, labor	2,500	2,500	.....
Present purchased power averages per kilowatt-hour $0.0275	2,098	.....	.....
Proposed purchased power based on $0.02 per kilowatt-hour	.....	.....	8,260
Fixed charge on new investment	.....	5,250	1,606
Total	$29,574	$29,146	$28,589
Saving in maintenance of lamps (new system recommended)	.....	1,153	1,153
Total cost per year	$29,574	$27,993	$27,436
Net saving	.....	1,581	2,138
New investment	.....	35,000	10,700
Per cent income on new investment	.....	4.5	19.5

It will be seen that the purchase of central-station power affords a return of 19.5 per cent on the investment against 4.5 per cent with power generated on the premises; furthermore, that the fixed charges on the increased investment for a power-house equipment practically offset the gain due to the better economy of turbine units over the original installation. While one turbine unit would carry the load, two would be required to insure continuity of service.

By means of efficiency engineering involving electric drive it was found that the production could be increased 25 per cent, if 30 tools in the machine shop were rearranged and individual-drive, adjustable-speed, direct-current motors varying in size from 3 to 10 horsepower installed. The total estimated cost of making this change to use purchased power was as follows:

Motors and control	$ 7,500
Mechanical changes	2,000
Fifty-kilowatt motor-generator set	1,500
Wiring	750
Total	$11,750

This analysis showed that $12,000 invested in the machine shop would bring greater returns than $24,000 invested in power-house additions, because of the improved facilities for doing work with increased producton and the decreased time required for repairs to motive power. Operating expense would necessarily be lower. The change was made to central-station power.

These examples show the advisability of a careful analysis of the cost of operation to determine the proper equipment to recommend. The central station should avail itself of competent efficiency engineers for this work. For the manufacturer it means increased production with decreased costs, and to the central station increased revenue with reduced costs.

It is hoped that the plan of campaign here outlined, which has proved its practicability wherever it has been thoroughly tried, will be adopted by all classes of central stations.

An Example of Good Will.

There have been a good many discussions recently as to what constitutes the value of "good will," as applied to public service corporations. An excellent demonstration of the reality of this value was given recently at Morganfield, Ky., when the driving belt at the power plant of the Morganfield Light & Power Company broke. Not being able to replace the belt immediately, the plant was shut down for two days, considerable inconvenience being caused to users of current for power, who were unable to operate. Evidently the company has treated its patrons "right," and has established a tangible asset in the way of good will, for the *Morganfield Post*, which was affected by the breakdown, referred to it as follows:

"On account of this accident there was no edition of *The Post* on Friday. All our machinery is supplied with power from this plant, and we were unable to complete an edition which was under way at the time the breakdown came. No word of complaint was heard from any of the concerns affected by the breakdown. The Morganfield Light & Power Company has been supplying power for the operation of these various plants for three years, and this is the first time that we have had as much as an hour's delay. We could not ask for better service. It is a fine plant under capable management, and the public realized that this delay was unavoidable."

Raises Heating Rate.

Having found that the cost of producing heat had risen so rapidly that its old rates were unprofitable, the Princeton (Ind.) Light & Power Company has notified its customers that rates are to be increased from 12.5 to 15 cents per square foot of radiating surface. The company installed a hot-water heating system twelve years ago, and since then the cost of coal has risen until it is over twice as high as it was before. In its notice to its customers, the company asserts that it faces the alternative of increasing its revenue or going out of business.

Electrical Construction

Elementary Notes on Alternating Currents.—I.

In the space around a magnet of any of the usual types there is what is known as a magnetic field, and in such a field the magnetic force is generally understood to be exerted along quite definite lines. These are known as lines of magnetic force, or simply as lines of force. Every ordinary magnet has two poles, of course—a north pole and a south pole—and for convenience of definition the direction of the lines of force is assumed to be from the north pole toward the south pole. That is, the lines of force leave the magnet at its north pole, pass through the surrounding medium and enter the magnet again at the south pole.

So far as the science of electricity is concerned, perhaps the most important of all discoveries was made when it was found that voltage may be induced in a copper wire either by moving the wire through a magnetic field so as to cut across lines of force, or by moving the field itself across the wire. This voltage will establish an electric current in the wire, of course, if the latter is part of a complete circuit, which current will continue until the circuit is opened or the cutting of magnetic lines stopped.

Generating electricity by this process is termed electromagnetic induction. The process will be referred to hereafter simply as induction.

The dynamo is an induction machine. As most electricians know, this machine consists of two principal parts, one of which is stationary, and the other kept rotating while the dynamo is in operation, the two members being known, respectively, as the field and the armature. In the case of the direct-current dynamo the field magnets are stationary. The rotation of the armature causes the copper conductors with which it is wound to cut lines of force due to the presence of the field magnets, and an induced voltage results.

In most modern alternating-current dynamos, or alternators, as they are called, the armature is stationary. As the field rotates the lines of force about its magnetic poles sweep across the armature conductors, and thus electricity is induced in them.

Fig. 1 shows the general arrangement of the principal parts of an alternator.

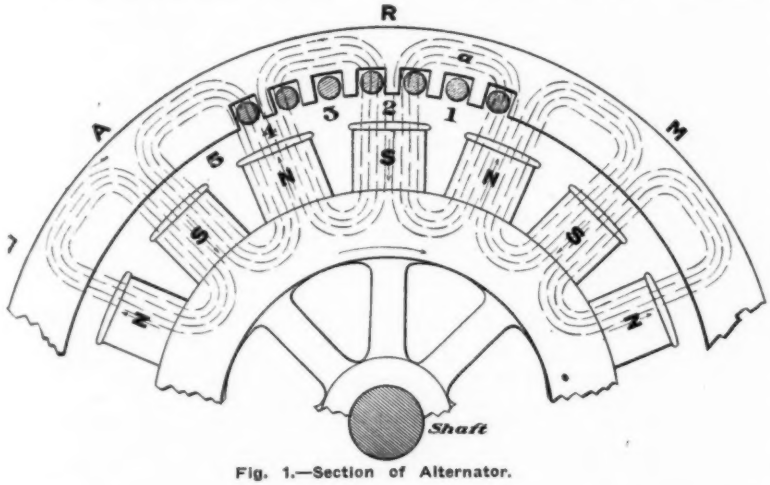


Fig. 1.—Section of Alternator.

That part of the armature shown is marked A R M, and a few of the slots in which the armature winding is placed are indicated in the drawing and sections of the wires shown. The north poles of the field are marked N and the south poles S. The windings employed on these poles to energize them are not shown, as this is not necessary to this discussion. The paths of the lines of magnetic force of the alternator field are indicated, in a general way, by means of the curves made up of light, broken lines, and the short arrows mark the directions of these lines across the air gap.

The alternator field structure is supposed to rotate to the right, as is indicated by the curved arrow.

In the following discussion it should be borne in mind that in order to avoid confusing the figure only a few lines of force are shown in Fig. 1. It must be remembered that in a commercial type of alternator the number of lines of magnetic force per square inch crossing the air gap is usually greatest about the center of a field pole, and that from here the lines grow constantly fewer until a point midway between two adjacent poles is reached, where the number of lines crossing the air gap to the armature is zero.

In order to make clear the definitions which follow, it is best to consider for the moment only the induction in a single conductor in the armature in Fig. 1, such as the one marked *a*. It is necessary also to explain that the instantaneous values of the voltage induced in a conductor depend upon how fast it is cutting lines of magnetic force. The direction of the induced voltage is determined by the direction of the lines of force and the direction of motion of the wire through the magnetic field.

From the foregoing remarks it is clear that when conductor *a* is at some such point as *1* it will be cutting no lines of force and the induction in it will be zero. As the point *2* approaches the induction increases continuously, and the voltage reaches a maximum value at *2*, since this is a point of maximum number of lines of force per square inch. Passing this point the voltage decreases continuously until it becomes zero, when conductor *a* is at *3*. Here the wire enters the magnetic field of a north pole, in which the direction of the lines of force is opposite that of the lines about the pole just passed. Hence the induced voltage *alternates* or changes its direction in the wire as this point is passed. The induced voltage in *a* will obviously attain a second maximum value at *4* and will become zero again at *5*.

When the wire has reached this last position it is in exactly the same condition as it was at *1*; that is the voltage has gone through a complete series of changes and the wire is again ready to enter the magnetic field about a south pole of the alternator. The series of changes through which the induced voltage when in the interval from *1* to *5* is known as a *cycle;* the voltage completed one cycle while that part of the field between *1* and *5* was passing armature conductor *a*.

The explanation applied to wire *a* is

applicable to the entire winding of an alternator armature. The voltage in the winding completes a cycle in the interval required to carry two poles of the field past any point in the armature. Hence the number of cycles per revolution of the field is equal to half the number of field poles. This quantity multiplied by the revolutions per second obviously gives the cycles per second, which quantity is termed the *frequency* of the alternator.

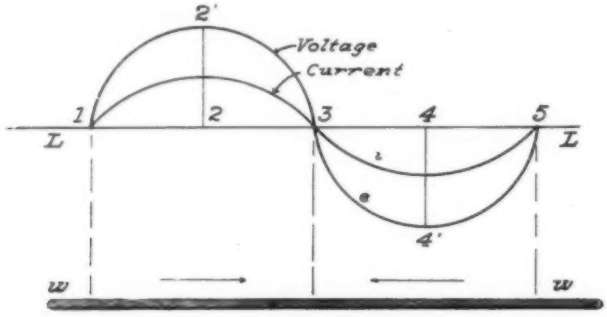


Fig. 2.—Voltage and Current Relations When Power-Factor Is Unity.

The frequencies in most general use are 60 and 25 cycles. Sometimes the frequency of a piece of alternating-current apparatus is stated in alternations per minute. It becomes evident upon slight consideration that there are two alternations in each cycle. A frequency of 60 cycles per second is equivalent to 7,200 alternations per minute.

The time of one cycle is called the *period* of the voltage or current. Thus, if the frequency is 60 cycles, the period is a sixtieth of a second.

It is understood, of course, that the voltage alternates with the same frequency in any part of a circuit supplied with energy by an alternator as in the alternator armature itself. Moreover, the current has the same frequency as the voltage. However, for reasons to be pointed out in a later paper, the change in the direction of the current may not occur at the instant when the voltage undergoes an alternation. The change may occur later or even earlier. In the first case the current is said to *lag* behind the voltage, while in the second we have a *leading* current.

The voltage values considered in connection with the discussion of Fig. 1 are instantaneous values. Alternating-current voltmeters indicate *effective* voltages, and the effective voltage is usually about 70 per cent of the maximum value of the instantaneous voltages. Ammeters likewise indicate effective and not instantaneous amperes in an alternating-current circuit.

By multiplying together the readings of the voltmeter and the ammeter the watts delivered to a direct-current circuit may be obtained. This is also true of an alternating-current circuit if there is no lag or lead of the current; that is, if current and voltage are *in phase*. Then the quantity known as the *power-factor* is unity, or 100 per cent. If the current and voltage are not in phase, the power-factor is always less than 100 per cent, and to obtain the watts the product of volts and amperes must be multiplied by the power-factor. There are power-factor meters in common use. Where these are not installed, and an indicating wattmeter is available (not a watt-hour meter) the power-factor may be computed by dividing the reading of this instrument by the product of volts and amperes. On an incandescent lamp load the power-factor is nearly 100 per cent usually, while on a circuit carrying only small induction motors it may be as low as 60 or 70 per cent.

Obviously, power-factor may be defined as a quantity determined by the lag or lead of the current, and by which the product of volts and amperes in an alternating-current circuit must be multiplied in order to obtain the wattage.

Instantaneous values of alternating voltages and currents may be conveniently and very simply represented by means of curves. For example, on the line LL, Fig. 2, a length *1-5* may be chosen to represent to any convenient scale the linear distance between points *1* and *5* in Fig. 1, and the value of the induced voltage in conductor *a* when any point in the field between these two limits is passing it may be represented by a perpendicular distance from line LL. When *a* is at *2*, (Fig. 1) for instance, the voltage has reached a maximum value which is represented by the line *2-2'* in Fig. 2. At *4* (Fig. 1) there is another maximum of voltage which may be represented by a line *4-4'* of equal length; but since this voltage is in the opposite direction, line *4-4'* is drawn downward. When a sufficient number of points like *2'* and *4'* are similarly plotted, a picture of the voltage variation throughout the cycle may be obtained by drawing a smooth curve through them.

The current curve is also drawn in Fig. 2. It is assumed there that current and voltage are in phase. Hence their zero values occur simultaneously and the curves cross the horizontal line at the same points. Below the curves a wire *ww* is shown with arrows added, in order to emphasize the fact that the directions of the current in the two halves of the cycle are opposite.

The speed of the alternator being uniform, or approximately so, the time required to carry that portion of the field between points *1* and *5* in Fig. 1 past any armature coil is proportional to the distance between these points. The line *1-5* in Fig. 2 may therefore be taken to represent by its length the duration of one cycle, or one period. In these and the next two figures time is supposed to be measured from *1* toward the right.

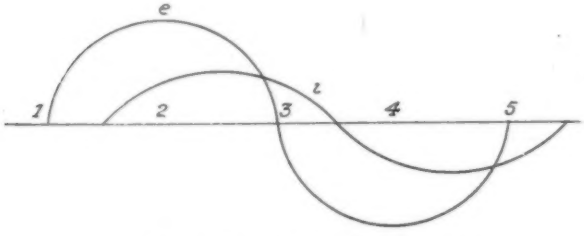


Fig. 3.—Curves of Voltage and Current.

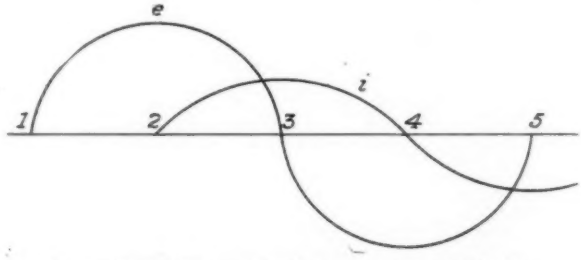


Fig. 4.—Illustrating a Lag of a Quarter of a Period.

Fig. 3 represents current and voltage relations when the current is lagging about an eighth of a period, the lag being indicated by the fact that the current wave has its first zero value shown at a point one-eighth of the length of the line *1-5* to the right of point *1*. In Fig. 4 the current is lagging a quarter of a period.

From a study of Fig. 5 an approximate method of finding the power-

factor when the lag of the current is known may be deduced. If a circle is drawn to any convenient scale and the angle G O H constructed so as to be that fraction of 360 degrees which the current lag is of one period, and G H is drawn parallel to O F then O H divided by O G is the power-factor. Where the lag is a quarter of a period, as in Fig. 4, O G will coincide with O F and O H will be zero; hence the power-factor is seen to be zero. Therefore the power delivered to the circuit is zero. In a case of this sort the entire current is said to be *wattless*.

If for any lag whatever the radius O G of the circle be taken to represent by its length the total current flowing in the circuit, then G H represents to the same scale that part of the total current which is wattless, or useless so far as producing power is concerned.

If the power-factor of a circuit is, say, 50 per cent, half the current delivered to it is wattless. To supply

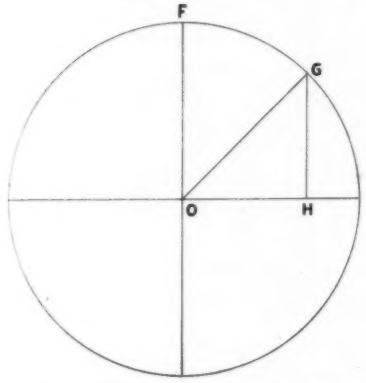


Fig. 5.—Diagram for Estimating Power-Factor and Wattless Current.

50 kilowatts to such a circuit without exceeding the current rating of the alternator, a 100-kilowatt alternator would be needed. Under such conditions, however, the engine driving the alternator would have to supply but little more power than to drive a 50-kilowatt generator.

To return to Fig. 5, the use made of it in the discussion suggests the plan of stating current lag or lead in degrees. This, in fact, is a very common method of stating phase differences in alternating-current circuits. A lag of a quarter of a period, for example which would be represented in Fig. 5 by the angle F O H, is often referred to as a lag of 90 degrees. When this system of designation is employed, the line *1-5*, in Figs. 2, 3 and 4, is taken to represent 360 degrees, and the points *1* and *5* in Fig. 1 are said to be 360 electrical or pole degrees apart. This matter will be referred to again when the subject of two-phase and three-phase apparatus is taken up.

It is interesting to note in conclusion that the use of the oscillograph to obtain current and voltage curves such as those shown in Figs. 2, 3 and 4 is quite common in engineering practice. Curves taken from an alternator are generally steeper and less uniform than those shown in the figures.

Copper Production in Eastern States.

The total value of the mine output of gold, silver, copper, lead, and zinc in the Eastern or Appalachian States for the year 1911, according to H. D. McCaskey, of the United States Geological Survey, was $11,787,942, against $10,127,304 in 1910.

The copper production from copper and iron ores was 19,605,386 pounds, valued at $2,450,674, an increase of 1,681,974 pounds in quantity and of $174,401 in value as compared with the figures for 1910. All the increase in output was credited to the mines of the Ducktown district in Tennessee, which contributed 96 per cent of the output in 1911 and 94 per cent in 1910.

Wiring Conditions in Quebec City.

The Canadian Fire Underwriters' Association, through James Bennett, chief electrical inspector, appeared before the Quebec Public Utilities Commission, in Quebec city, recently in connection with complaints made as to the electrical conditions existing in that city. Mr. Bennett said that the conditions as to overhead wires were dangerous and a menace to life; in some places the wires of the telegraph companies were placed on poles belonging to the Quebec Railway, Light, Heat & Power Company, creating a hazardous condition; there were also a large number of call boxes in business places without any protective devices and these were not installed in a proper manner. He asked that the defects be remedied, in accordance with the rules of the National Electrical Code.

The Commissioners agreed with the methods of protection suggested by the Fire Underwriters, and ruled that within ten days all the companies and all the systems complained of must be rigidly inspected by the companies and the defects rectified. The Commissioners also ruled that where the lines of different companies cross at right angles or parallel one another when not on the same poles a minimum separation of 36 inches must be maintained; where they are held upon the same poles a minimum distance vertically of 26 inches will be required; and where they are on the same cross-arms a separation of 24 inches must be maintained.

Railway Signal Association.

The June meeting of the Railway Signal Association was held at the Hotel Astor, New York City, June 11 to 13. An executive meeting of the board was held at 11 o'clock Tuesday morning, C. C. Anthony, the president, in the chair. C. C. Rosenberg is secretary.

On Wednesday and Thursday the reports of the various committees were presented by the chairmen as follows:

"Mechanical Interlocking Signals," by C. J. Kelloway, chairman.

"Power Interlocking Signals," by B. H. Mann, chairman.

"Automatic Block Signals," by A. G. Shaver, chairman.

"Manual Block Signals," by T. S. Stevens, chairman.

"Signaling Protection and Stations," by J. C. Mott, chairman.

"Alternating-Current Signaling," H. S. Balliet, chairman.

"Storage-Battery Signaling," by R. B. Elsworth, chairman.

"Wires and Cables," by W. H. Elliott, chairman.

"Contractors," by L. R. Clausen, chairman.

"Definitions," by A. D. Cloud, chairman.

There were over 100 present. Among those in attendance were A. P. Eckert, of the National India Rubber Company; Messrs. W. L. Candee, Martin and Underhill, of the Okonite Company; W. R. Brixey, Azel Ames and Mr. Miller, of the Kerite Insulated Wire & Cable Company; Messrs. Hudson and Brown, of Thomas A. Edison, Incorporated; W. S. Sisson, of D. & W. Fuse Company.

Among the Contractors.

The Hunter Electric Company, Eugene, Ore., of which George F. Willoughby has for some time past been sole proprietor, is doing the wiring of the new 75,000-dollar Methodist Church in Eugene. This company also did the electrical work on the First Christian Church, which was recently built.

The Bland Electric Company, of Louisville, Ky., has the contract for wiring the new office building of the Kentucky Electric Company, of Louisville, which is now in course of construction. The job is an important one on account of the elaborate system of indirect lighting provided for the exterior.

The H. H. Hunter Electric Company, of Salem, Ore., is wiring the new seven-story Masonic Temple Building in that city. The job is in conduit work throughout.

C. A. & G. A. Elkins, electrical contractors of Albany, Ore., have recently opened a store at 215 Lyon Street, where a stock of fixtures and supplies will be kept on hand.

Concerning the Installation of Motors.

The Underwriters' Equitable Rating Bureau of Portland, Ore., has lately prepared one of the most comprehensive collections of rules and tables for the guidance of contractors and others installing electric motors that has come to our attention. The tables cover such matters as full-load current and proper sizes of fuses, switches and leads for both direct-current and alternating-current motors of practically all machines of the more commonly used types and sizes. Some of the data concerning induction motors and special installations of motors of other kinds are given in the following notes:

TABLE I.
INDUCTION MOTORS—SINGLE-PHASE, 110 VOLTS, ALL FREQUENCIES, STANDARD SPEEDS.

Horsepower.	Approximate full load current amperes.	Size of wire B. & S. Gauge.	Size of switches in amperes.	Size of starting fuses, amperes.	Size of running fuses, amperes.
1.....	16.4	10	25	25	20
2.....	24	8	50	45	30
3.....	33.6	6	75	70	45
4.....	43.6	4	75	85	60
5.....	54	4	100	100	70
7.5...	80	1	150	150	100
10.....	106	0	200	200	125

TABLE II.
INDUCTION MOTORS—SINGLE-PHASE, 220 VOLTS, ALL FREQUENCIES, STANDARD SPEEDS.

1.....	8.2	14	15	15	10
2.....	12	10	25	25	15
3.....	16.8	8	50	35	20
4.....	21.8	6	50	45	25
5.....	27	6	50	55	35
7.5...	40	4	75	75	50
10.....	53	2	100	100	99

Motors Operated on Current from Grounded Railway Circuit.

When stationary motors are operated on a railway circuit having a grounded return, the motor must be located on the ground floor, or in the cellar or basement if the building has one, and the frame of the motor must be insulated from the ground. The positive wire upon leaving the last pole before entering the building shall be protected by a lightning arrester located on the pole, after which the wire shall be carried downward and enter an approved conduit at a distance of not less than ten feet above the ground. The conduit shall extend straight down the pole until it reaches the earth and in one continuous channel from this point the entire distance under ground until directly under the motor, where it shall emerge from the earth, the positive wire being drawn through this conduit and entering the proper circuit-breaker, switch and rheostat, which shall be located contiguous to the motor and mounted on special framework set for the purpose, the same being clear of any woodwork or other combustible material. The return wire shall, upon leaving the negative terminal, be carried directly to the conduit just mentioned and be made electrically and mechanically secure to it at the nearest practical point. Also, the return wire shall be tapped in multiple with the wire from the negative terminal at this point, which return wire shall be run in the same conduit with the positive wire and made mechanically and electrically secure to the track or other return circuit of the railway company outside the building.

TABLE III.
INDUCTION MOTORS—TWO-PHASE, 110 VOLTS, FOUR-WIRE, 60 CYCLES, STANDARD SPEEDS.

Horsepower.	Approximate full load current, amperes.	Size of wire, B. & S. gauge.	Size of switches in amperes.	Size of starting fuses, amperes.	Size of running fuses, amperes.
1...	5.2	14	15	10	8
2...	10.4	12	25	20	15
3...	15.6	10	25	30	20
4...	22.2	8	50	45	30
5...	33.8	6	75	70	45
7.5..	44.2	4	75	90	60
10...	64.8	2	150	130	80
15...	87.5	1	150	175	110
20...	108.2	00	300	225	150
25...	129.8	000	300	275	175
30...	151.4	0000	300	300	200
35...	181.7	250000	300	350	225
40...	213	300000	500	450	275
50...	322	550000	700	650	400
75...					

The foregoing specifications are intended to bring about such construction that the positive wire will always be surrounded by its own return path, and said path be so arranged that there shall always be practically an equality of potential between the earth and the normal return conductor at all points, thus obviating the tendency to an arc between possible ground returns and also bringing any possible arc between the positive and the negative conductors within so limited a space that no damage could be done.

It is further intended that the conduit referred to shall act as a choke coil in providing additional protection against lightning discharge, and that should such discharge occur it should act to deflect the same in the direction of the lightning arrester.

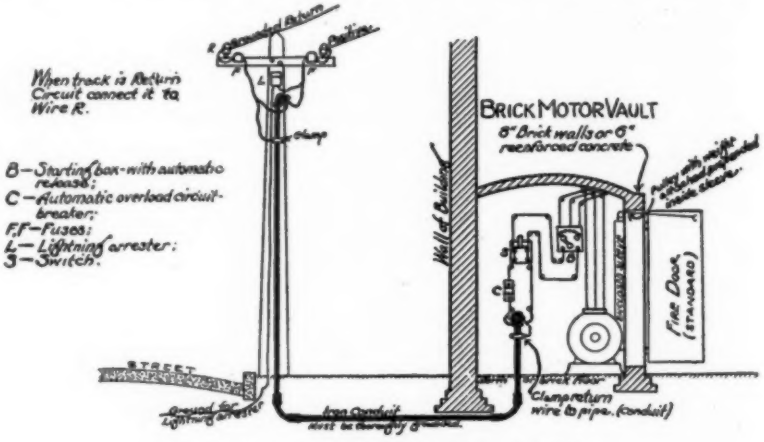
If the motor is located in a building containing property susceptible to loss from smoke, the motor vault is to be ventilated to the outside air, each separate case to be taken up with the inspection department.

In these tables there is no attempt to cover all the possible conditions to which motors are subjected and the various special designs which are devised to meet severe operating conditions.

The voltage drop is not considered in any of these tables.

With auto-starters of the types which use two single-coil transformers on two and three-phase circuits, the middle fuse on the three-phase system on the "Running Side" will have to be used of a capacity equal to the size of "Starting Fuses," and when this type of starter is used on a two-phase four-wire circuit, one fuse in each phase will have to be increased in capacity to "Starting Fuse" size on the "Running Side" of the circuit.

When manually operated oil-immersed switches and air-cooled compensators are provided which have over-load and no-voltage release coils, and the overload release is inoperative during the process of starting the motor, this device will be accepted as a substitute for the "Running Fuse." That is, if the above switch is provided with at least two trip coils installed in different leads, the coils being set at no more than 150 per cent of the full-load current on which the device is installed, the same will be acceptable. Starting fuses must be always furnished even when the above device is provided.



Wiring to Motor on Circuit Having Grounded Return.

TABLE IV.
INDUCTION MOTORS—TWO-PHASE, 220 VOLTS, FOUR-WIRE, 60 CYCLES, STANDARD SPEEDS.

Horsepower.	Approximate full load current amperes.	Size of wire B. & S. gauge.	Size of switches in amperes.	Size of starting fuses, amperes.	Size of running fuses, amperes.
1...	2.6	14	15	5	3
2...	5.2	14	15	10	6
3...	7.8	14	25	15	10
5...	11.1	12	25	25	15
7.5..	16.9	10	50	35	20
10...	22.1	8	50	45	25
15...	32.4	6	75	65	40
20...	43.75	4	75	85	55
25...	52.1	4	100	100	65
30...	64.9	2	150	130	80
35...	75.7	1	150	150	95
40...	90.8	0	150	175	115
50...	106.5	00	200	200	135
75...	161	0000	300	325	200
100..	210	300000	400	400	250
150..	415	750000	500	825	525

Where the circuit-breaking device on the motor-starting rheostat or compensator disconnects all wires of the circuit the switch called for in this section may be omitted.

An automatic circuit-breaker disconnecting all the wires of the circuit may, however, serve as both switch and cut-out when installed without other automatic over-load protective devices. Automatic over-load circuit breakers must have the poles and trip coils so arranged as to afford complete protection against over-loads and short-circuits, and if also used in place of the switch, must be so arranged that no one pole can be opened manually without disconnecting all the wires.

TABLE V.

INDUCTION MOTORS — THREE-PHASE, 440 VOLTS, ALL FREQUENCIES AND STANDARD SPEEDS.

Horsepower	Approximate Full Load Current Amperes	Size of Wire B. & S. Gauge	Size of Switches in Amperes	Size of Starting Fuses Amperes	Size of Fuses Running Amperes
1....	1.5	14	15	5	3
2....	3	14	15	10	5
3....	4.5	14	15	15	6
5....	6.7	14	25	20	10
7.5..	9.8	12	25	25	15
10...	12.8	10	50	35	20
15...	18.8	8	50	50	30
20...	25.2	6	75	75	35
25...	31.3	6	75	75	50
30...	37.5	4	75	90	55
35...	43.8	4	100	100	65
40...	52.5	2	150	135	75
50...	61.5	0	150	175	90
75...	93	00	300	225	140
100..	121.5	000	300	275	175
150..	181	300000	400	400	275
200..	240	450000	500	550	350

TABLE VI.

INDUCTION MOTORS — THREE-PHASE, 110 VOLTS, ALL FREQUENCIES AND STANDARD SPEEDS.

Horsepower	Approximate Full Load Current Amps.	Size of Wire B. & S. Gauge	Size of Switches in Amperes	Size of Starting Fuses Amperes	Size of Running Fuses Amperes
1...	6	14	15	15	9
2....	12	12	25	25	18
3...	18	10	50	35	27
5....	27	6	75	65	40
7.5.	39	4	75	80	58
10...	51	2	150	125	75
15...	75	1	150	150	112
20...	101	00	300	225	150
25...	125	000	300	250	187
30...	150	0000	300	325	225
35...	175	300000	400	400	262
40...	210	400000	500	500	315
50...	246	450000	500	550	369

Alternating-Current Motors.

The tables on alternating-current motors are for standard speeds (1,800 to 1,200 revolutions per minute) and for installations where motors do not start under full load. Sizes of wires, switches, etc., for slow-speed motors should be larger in proportion, as the full load current of the slow-speed motor is larger than the value given in the table, for a motor of standard speed. Add 12 per cent for speeds of 900 to 600 revolutions per minute. In some cases and under some circumstances this percentage will not be sufficient.

Values given in the tables for sizes of wire, switches and fuses are not large enough for motors which start under practically full load or greater, such as motors operating pumps or compressors starting under full pressure, rock crushers, or machinery having heavy flywheels.

Where several motors are supplied from one service or from the same feeders, size of service or feeder wire may be determined by using the figures in columns marked "Approximate Full-Load Current" for all motors plus 50 per cent of the full-load current of the largest motor.

If the starting current exceeds the value of the "Weatherproof rating" of the rubber-covered wire specified in the table for use with a given horsepower, the size in the table must be increased to a size corresponding with the starting-current value.

Auto-starters must be provided for motors of 7.5 horsepower or larger.

TABLE VII.

INDUCTION MOTORS — THREE-PHASE, 220 VOLTS, ALL FREQUENCIES AND STANDARD SPEEDS.

Horsepower	Approximate Full Load Current Amperes	Size of Wire B. & S. Gauge	Size of Switches in Amperes	Size of Starting Fuses Amperes	Size of Running Fuses Amperes
1....	3	14	15	10	5
2....	6	14	15	15	10
3....	9	12	25	25	15
5....	13.3	10	50	35	20
7.5..	19.5	8	50	45	30
10...	25.5	6	75	65	40
15...	37.5	4	100	100	60
20...	50.5	2	150	130	75
25...	62.5	1	150	150	95
30...	75	0	200	200	100
35...	87.5	0	200	200	125
40...	105	00	300	225	150
50...	123	000	300	250	175
75...	186	300000	400	400	275
100..	243	450000	500	550	350
150..	362	800000	800	850	550
200..	480	1200000	1000	1150	725

TABLE VIII.

INDUCTION MOTORS—THREE-PHASE, THREE-WIRE, 2200 VOLTS, 60 CYCLES, TWO STANDARD SPEEDS.

Horsepower	Speed	Approximate Full Load Current	Size of Wire B. & S. Gauge	Size of Oil Switch in Amperes	Size of Starting Protection Amperes	Size of Running Protection Amperes
15	1800	3.7	14	60	10	5
	1200	3.9	14	60	10	5
20	1200	5.4	14	60	15	10
	900	5.8	14	60	15	10
25	1200	6.5	14	60	20	10
	720	7.2	14	60	20	10
35	1200	8.9	12	60	25	15
	720	9.8	12	60	30	15
50	900	13.7	10	60	40	20
	514	14.3	10	60	40	20
75	900	19.0	8	60	60	25
	514	20.7	8	60	60	30
100	720	24.4	6	100	75	35
	450	27.2	6	100	80	40
150	720	36.8	4	100	110	50
	450	40.9	2	200	125	60
200	600	50	2	200	150	75
	400	54.5	2	200	150	75

Specifications for the Installation of High-Tension Motors Inside Buildings One Motor Only. 550 to 3,500 Volts.

On pole outside of building locate three transformer fuses as starting fuses, isolated from all combustible or inflammable materials.

All wiring must be done with approved multiple conductor metal sheath cable in approved unlined conduit.

All wiring around switchboard must be done with approved rubber insulated wire. This wire must be of approved make for this potential—ordinary 0 to 600-volt wire is not approved.

All open wiring must be supported on porcelain insulators at least 1 inch high, and wires must be 8 inches apart.

Use bushings on the ends of all conduit, as a terminal fitting. Do not use outlet boxes or condulets.

No iron cabinets can be used. Use wood—slate or marble lined—that is, build the cabinet of wood.

Wherever lead-covered cable leaves conduit, place a pothead on the lead-covered cable and fill it with asphaltum so as to separate wires. This pothead should be at least twice the diameter of the metal-sheathed cable.

Inclose the motor in a dustproof room when direct-current motors, or motors with sparking contacts, are used.

Place the starting panel in the motor room; also the auto-starter and the oil switch. If no room is provided one must be built for this apparatus.

Ground thoroughly the motor frame, the conduit and the metal-sheathed cable. This grounding must be done with approved clamp.

On the outside of the building the conduit must be turned downward with a bushing on the same and a pothead must be used on the lead-covered cable.

Connect the starting terminals of the compensator between the oil switch and circuit breaker on the starting panel, making the circuit breaker on the panel the "Running Fuses."

If it is necessary to dead-end to the building, place several strain insulators in series.

Motor must be so located that it will be readily seen from the auto-starter.

When fuse sizes exceed 400 amperes in any of the foregoing tables, approved circuit-breakers must be used.

Efficient illumination in any mill or factory secures a twofold economy; it increases the output of the factory and decreases the cost of production. It is obviously impossible to get the best and quickest work out of operators who are constantly hindered and rapidly tired by inefficient and glaring methods of lighting.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Prolonging Life of Ignition Batteries.

Upon looking over the issue of May 25, I noticed on page 996 a kink on prolonging life if ignition batteries. In this article the suggestion of pouring tar over cells to keep them from drying out is made.

The National Carbon Company some time ago recognized the advisability of inclosing the cells in an air-tight box to prevent evaporation and to render batteries waterproof. The use of tar is a good one, but care must be taken that it is not too hot when poured over the cells. Dry cells are the sturdiest and least easily damaged sources of electrical energy, but susceptible, to some extent, to changes of temperature. Many cases have occurred where attempts have been made to pour molten tar over a number of cells to make a waterproof battery, with the result that the high temperature of the molten liquid tar has disturbed the equilibrium of the cell, resulting in poor shelf and service life. This fact has been recognized by the National Carbon Company and the most favorable conditions worked out by its research staff.

The Columbia multiple battery has all the advantages mentioned in the article and at the same time renders unnecessary any treatment by the owner. The battery in its various sizes is incased in a black enameled waterproof case of rectangular shape. The cells are specially selected and thoroughly tested and connected in multiple-series by means of copper strips of ample current-carrying capacity. All connections are soldered and made electrically and mechanically secure. An insulating compound surrounds the various cells and holds them compact and immovable in a composite unit. The case is hermetically sealed so that the battery is practically indestructible. It is absolutely reliable, easily installed and possesses an exceptionally long life and a very low drain per cell. The batteries may be exposed to all conditions of weather without any possible damaging effects on shelf or service life.

E. W. Kronbach.

Cutting Fiber Tubing.

In cutting loom of the size used on No. 12 or No. 14 wires the electrician often proceeds by drawing the edge of the knife employed for the purpose back and forth in a straight line against the side of the tubing, pressure being applied by holding the thumb of the hand in which the knife is held on the side of the tube opposite the knife edge. The motion of the knife is very much like that of a hand-saw in ordinary use. Loom can be cut much more quickly and smoothly if the sawing motion be combined with another motion which carries the cutting edge back and forth partly around the tube at every stroke. This sort of cutting can be easily done by holding the wrist rather rigid and raising and lowering the elbow of the knife hand. This suggestion is one well worth the consideration of beginners in the wiring business.

M. Claiborn.

Interesting Transformer Connection.

The diagram shows a convenient method of connecting the secondary of

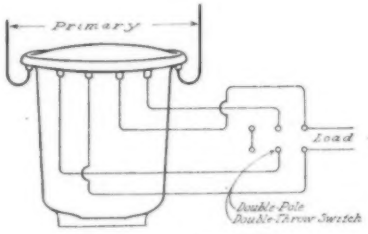


Diagram of Connections.

a transformer so as to apply two different voltages to a circuit. When the double-pole, double-throw switch is thrown to the right the secondary coils are in multiple. The voltage applied to the circuit is half that obtained by throwing the switch into the other position.

S. E. Moore.

Fishing Wires in Long Runs of Conduit.

I used the method described below in pulling in all the work in the new Municipal Court Building in St. Louis, and found it to be a particularly good one. Believing that the idea may be new to some readers, I am describing it here.

When conductors have to be pulled into runs of conduit that are extremely long, and where a steel fish-wire has to be pushed into both ends of the pipe, there may be trouble in getting the fish steels to hook together. My way is to fasten or bend a hook on one steel only and on the end of the other to fasten several loops of catgut, such as fiddle strings are made of. These loops, which may be taped on, stand out open ahead of the advancing end of the steel, and make it very easy to hook the two fish-wires together.

George Reed.

Grounds on Street-Series Circuit.

We operate a three-phase, 2,300-volt system, and series incandescent street lights not using a constant-current transformer but an old type regulator with single return wire to the station, which, of course, is not automatic. This series wire is tapped on to one of the phase wires about three and a half miles from the station, goes all over town and back to the station and through the regulator.

One night before street lighting time a guy wire broke causing a ground on the series wire and about the same time a 2,300-volt cable became grounded. The ground on the series wire and the ground on the cable were about two miles apart. When the street lights were put on that night only twenty-three of the one hundred and fifty-three came on; so, of course, those twenty-three got the full voltage and were immediately burned out. The cause of those twenty-three lights getting the full voltage was that the ground on the series wire was twenty-three lights from the station and the ground on the cable was on one of the wires that the series wire was tapped on to. The current going from one ground to the other cut off the balance of the street lights. I located both of these grounds by the method I described in my article, "High-Frequency Coil for Locating Short-Circuits," in the Dollar Wiring Kinks in the issue of March 16.

C. A. Walbridge.

Soldering Terminal Lugs.

In soldering terminal lugs on wire those who have experienced any inconvenience from solder running over the outside of the lug and the latter becoming oxidized from the flame can apply the following rule to advantage. Tie a small piece of asbestos sheet around the top edge of the lug with wire and melt solder in the lug in the usual way, only do not fill it completely, but have it about two-thirds full. When hot enough, the wire end is inserted and the solder rises in the lug to the top. If it should overflow, the lug does not catch it, as the asbestos acts as a protector.

To polish off the oxidized appearance I carry a small portion of cleansing powder such as Dutch Cleanser, Sapolio or Bon Ami, which, rubbed on with a damp cloth, removes the tarnish as well as the remainder of burnt lacquer on the lug, and gives a good polish.

H. Piccard.

Work on the traction subway in Buenos Aires, Argentina, is being pushed very rapidly and it is expected that the first section will be opened in August. This is the first subway system in South America.

National Electrical Inspectors' Association

THOMAS HENRY DAY, President.
59 Deerfield St., Hartford, Conn.

JAMES BENNETT, Vice-President,
524 Coristine Bldg., Montreal, Que.

WILLIAM LINCOLN SMITH, Sec'y and Treas.,
Concord, Mass.

JAMES E. COLE, National Conference Representative,
11 Wareham St., Boston, Mass.

Executive Committee:

H. S. WYNKOOP, Chairman, 13-21 Park Row, New York

Frank R. Daniel, R. P. Strong, Henry E. Knight, Washington Devereux, James B. McCarthy, Wm. Lincoln Smith, James Bennett, C. W. Mitchell, George L. Collison, T. H. Fritts, James S. Meade, Thos. Henry Day, James E. Cole, Thos. D. McColl

Secretary's Message.

The Secretary wishes to announce that the following gentlemen have become members of the Association: Walter I. Fuller, Commissioner of Wires, Somerville, Mass.; Percy A. Blaisdell, Inspector of Wires, Everett, Mass.; Frank Mooney, City Electrician, 93 Baker street, Lynn, Mass.; and Herbert Burne, Municipal Electrician, Point Grey, Vancouver Heights Post Office, Vancouver, B. C.

The address of Emil Anderson should be changed on the list to read 1236-53 Plymouth Building, Minneapolis, Minn.

J. W. Disbrow has resigned from the Association. Letters formerly addressed to J. Alexander Parker of San Diego, and later of Sacramento, are returned undelivered. Can any one inform me of his address at the present time?

The Secretary has received word from the secretary of the American Institute of Electrical Engineers that Messrs. Daniel and Wreaks, both members of the Institute as well as of this Association, have been appointed on the Committee of Organization of the International Electrical Congress to be held in San Francisco in September, 1915, and will be accredited to the National Electrical Inspectors' Association, which I am sure all our members will deeply appreciate.

One of the most interesting questions which have come up for consideration recently is that entitled "Concerning Three-Wire Service"—Question 180, page 1051, in the June 1 number; and it is obvious from the replies that this is distinctly a question which can hardly be settled so simply as one might at first glance imagine. It will be recalled that the question relates to a 220-volt three-wire circuit. The queries were: *a.* With grounded neutral and plug fuses, is it permissible to run three wires through a building and connect 660 watts between the neutral and each outside wire, thus making a total of 1,320 watts on the three wires? *b.* Would it be permissible if the neutral was not grounded? *c.* Would it be permissible if the neutral fuse was omitted? *d.* Would the substitution of cartridge fuses make any difference?

One of our best Committee members and for whose opinion the Secretary entertains a high regard (when he can be aroused sufficiently from the ordinary routine of office work to present one) wrote as follows:

> **The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.**
>
> **It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.**
>
> **The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.**

"I am not answering 180, as an intelligent consideration requires more time than is possible under the circumstances. With a 220-volt circuit I think Rule 23*d* fully covers the grounding question. At the same time, 1,320 watts is not allowed on a sub-circuit, except in the case of theater borders, extra-large chandeliers and signs, for which special permits may be given. To be very frank, I think this is a catch question devised by some genius whose phraseology is so subtle as to wholly obscure his own meaning. The question as written may be answered in a half dozen different ways, and each as correct as the other. Personally and privately give me the inside of this question that I may study it out to my own profit."

This last paragraph is a jab at the Secretary, but our brother is mistaken; the question did not originate in his overheated imagination, and he regretfully admits that he knows nothing about it other than that it originated in Tennessee.

The question of the grounded or non-grounded neutral is not so immaterial as might seem, especially if we have provided individual control of the lamps by key sockets. In such a case suppose we had a large drafting room for students and it so happened that a number of men were working therein so distributed that one side was more heavily loaded than the other. A comparatively slight ground on the lightly loaded side might suffice to take out the neutral fuse, with possibly disastrous results to the lamps.

On the other hand, if the lamps were without individual control, and raised out of reach, and the occupancy of the room such that close balance was insured, the presence of the neutral fuse and ground would not cause this possible damage, which the Secretary actually saw occur twenty-three years ago in the freshman drawing room at Tech.

Again, the question of cartridge fuses is *not immaterial;* because if the neutral fuse is lost, the full 220 volts is immediately thrown on to the others and the Edison plug is not allowable on a 220-volt circuit unless the neutral ground is continuously maintained, and one would hardly find the ground on the load side of this cutout.

Incidentally, no one would think of objecting to a circuit of over six amperes capacity at 220 volts properly fused and used for a motor; and the provision for a large-capacity circuit for lights is also provided for in Rule 23*d*, second paragraph, and *no superior limit is assigned*, except as referring to Rule 38 we find that in some places we are definitely limited to 1,320 watts. In the main, however, the wattage of the special circuit is left to good engineering principles and the common-sense idea of not having all your eggs in one basket.

It would appear that the question, far from being a catch one, very possibly has in mind some specially desired and planned layout for a particular purpose, and, as I look at it, it should distinctly be considered under "special permission" section of Rule 23*d*. But as we must have the neutral fused, and as the loss or temporary removal of that fuse gives

a two-wire 220-volt circuit I should certainly call for cartridge fuses.

Some may suggest that the clause in question only refers to "large chandeliers"; but the provisions in Rule 38 show that an excess is allowable in other cases; and then some genius may argue that if the circuit is run in exposed conduit it is a "large chandelier" with its scrolls of tube and radial arms, etc., straightened out and put end to end!

It may seem that it would be much better to run a three-wire main with two-wire distributing branches and balance the load carefully; but a question like this is necessarily brief and presupposes not a catch question such as sometimes is sprung in an examination, but a real actuality which someone wants to use, and it is only fair to assume that there must be some reason more or less valid which makes it desirable under the special circumstances, provided it is allowable at all.

The above is to be read simply as the Secretary's personal reply to Question 180, and was prepared along with his answers to the other questions but in some way slipped out and was not found until too late.

Making Splices in Conduit Fittings.

Question 184. Is it permissible to make splices and taps in fittings of Condulet and similar types?

Answer 1. Yes.

Answer 2. No. Rule 26*a* provides that wire within the conduit should be without taps or splices. If this question refers to the use of junction boxes, it almost goes without saying that properly soldered and protected connections are allowed in such appliances.

Answer 3. Yes; these fittings have been approved by the Underwriters' Laboratories without restrictions as to how they shall be used, and presumably with the knowledge that they are intended as junction boxes. Some makes, however, are, in my judgment, far too small to properly accommodate splices or taps, and should be specifically disapproved for such purpose.

Answer 4. Yes, as they are practically junction or outlet boxes as the case may be.

Answer 5. Certainly, where there are not too many splices to be accommodated comfortably in the space available.

Answer 6. It is entirely permissible, but sometimes inconvenient owing to lack of space.

Answer 7. Yes. Splices can be made in a pipe fitting. These fittings correspond to outlet boxes in which splices are frequently made.

Answer 8. Yes.

Answer 9. Yes, certainly; provided the fitting is large enough to accommodate the joints without crowding. Some fittings which go with a size of conduit which accommodates a certain size wire on a straight run are not large enough to allow of properly made up tap joints.

Supports for Conduit on Girders.

Question 185. Where conduit runs at right angles to girders and is fastened on the under side of the same, what is the maximum distance that should be allowed between girders without additional supports of some kind for the conduit being placed between them?

Answer 1. Not over one length of pipe, or ten feet between supports.

Answer 2. Rule 28*b* must be complied with; that is, the entire system must be mechanically secure in position. The question of maximum distance between supports is entirely a matter of good judgment.

Answer 3. Not more than one length of pipe is a good general rule.

Answer 4. I do not see how a hard and fast answer can be given to this question. A great deal depends upon the size of pipe, and upon the location and number of the couplings and other fittings.

Answer 5. Rule 28*b* requires that "the entire (conduit) system must be mechanically secured in position," leaving to the inspector's judgment the necessary constructional details required to attain this result. In the case of the smaller sizes of conduit, on a girder work, we require a support at least every ten feet.

Answer 6. The answer to this question depends upon the size of the conduit and other purely local conditions. It cannot be answered off-hand and in a general way.

Answer 7. We could hardly determine the actual distances, in feet, between supports, conditions differing in buildings. The conduits should be rigidly supported. If the machinery, for example, should produce pronounced vibrations, then the supports should be near enough together to protect the conduits from loosening. It is a matter largely of personal judgment.

Answer 8. Rule 28*b* says: "the entire system must be mechanically secured in position." A great deal would depend on the construction and occupation of risk, but at least two rigid supports should secure one length of conduit, or as conduit comes in ten foot lengths, every five feet.

Answer 9. It would depend upon the local conditions entirely; viz., height of girders above floor, space between girders, character of building—that is, manufacturing or warehouse. Therefore, the writer would rule as follows: If in a manufacturing building where vibration of floors existed or in a warehouse where boxes, bales, crates, etc., were piled close to girders, supports would be necessary 24 inches apart. Where the above conditions did not exist, supports 4 feet apart.

Output of Coal in Maryland.

The statistics of coal production in Maryland, collected by Edward W. Parker, of the United States Geological Survey, in coöperation with the Maryland Geological Survey, show that the total production in 1911 amounted to 4,685,795 short tons, valued at $5,197,066. Compared with the production in 1910, the output in 1911 showed a decrease of 531,330 short tons, or 10.2 per cent, in quantity, and of $637,992, or 10.9 per cent, in value. Stimulated by the strike of miners in the Middle West, Maryland in 1910 increased her production nearly 1,200,000 tons over 1909, and a part of the markets secured at that time were held in 1911, but not sufficiently to maintain the tonnage of the preceding year. The coal mines of Maryland gave employment in 1911 to 5,981 men, who worked an average of 243 days, against 5,809 men for an average of 270 days in 1910.

Improved Conditions for Wiremen.

The London members of the Electrical Trades Union recently held a meeting to consider methods of securing improvement in the conditions of the various grades employed in the electrical industry. A movement was started looking toward an increase to one shilling per hour in the wages of electrical wiremen and fixing the hours of labor at 48 per week.

Wireless Telephony.

Reports from France state that recent experiments in wireless telephony have established new records in this art. Admirable results have been obtained between war vessels about 100 miles apart during heavy gun fire when the transmission of signals was particularly difficult. It is reported that music has been heard over a distance of more than 400 miles.

Among the Supply Men

New Electrical Store in Durham Has Big Opening.

A real electrical celebration at "Elliott's Electrical Store," Electrical Building, Durham, N. C., was the electrical event of that city on Friday evening, May 10. The occasion was the formal opening of Elliott's large new retail and wholesale supply house, which will handle electrical fixtures, incandescent lamps, appliances, and accessories. On the night of the opening the store was specially trimmed, and provided with elaborate display lighting for the occasion. A musical entertainment was rendered by the Durham orchestra assisted by R. H. Westbrook, whistler, and Miss Alice Hundley, pianist. The opportunity of listening to this excellent musical talent was one of the factors that attracted over 4,000 people to the store on the evening of its opening. The event had been widely advertised by means of hand-bills and through the local newspapers. Souvenirs were distributed to all visitors, but nothing was sold on the opening night.

Electrical Display
and Formal Opening
of
Elliott's Electrical Store

Friday Night, May 10th, 1912
7:30 to 11:00 o'clock

A cordial invitation is extended to all. If you use electric lights, come. If not, come. A souvenir has been prepared for every lady, gentleman, boy and girl

Music by the Durham Orchestra
Assisted by Mr. R. E. PIPER, Bass Soloist; Mr. R. H. WESTBROOK, Whistler; Miss ALICE HUNDLEY, Pianist

The musical programme will be a special feature. Mr. Piper's singing and the whistling of Mr. Westbrook is of itself enough to entertain thousands. Miss Alice Hundly, Durham's most accomplished pianist, will preside at the organ

Souvenirs Free
to every person in attendance, no matter how large or small. Just come out and enjoy the evening by inspecting our elaborate line of chandeliers. Nothing sold during the opening night

Elliott's Electrical Store
Electrical Building **227 W. Main Street**

Poster Announcing Opening of New Store.

The Gilson Electrical Supply Company, 417 Fifteenth Street, Oakland, Cal., was organized less than a year ago to do a jobbing business in electrical supplies.

Its selling organization extends throughout the state of California and it is a principle of the company to do a strictly wholesale business, no retail business is transacted whatever.

The head of this company, C. L. Gilson, was for two years local manager of the Pacific States Electric Company in Oakland, and for seven years previous to that was manager of the Crescent Electric Company of Oakland. His wide acquaintance and personal popularity, coupled with a liberal sales policy, has done much to establish the large measure of success with which this company has met.

The Ralston Electric Supply Company, of Albany, Ore., does, in addition to local electrical contracting, a jobbing business in electrical supplies throughout the state of Oregon. A recently acquired agency is that of the "Sechrist" patent electroliers, of which the company has the exclusive sale throughout Oregon and Washington.

A complete stock is carried in Albany. J. H. Ralston, who is manager of this company, is also president of the Oregon State Contractors' Association, which was organized in the fall of 1911.

The Southern Electric Company, Baltimore, Md., reports business good throughout its territory, covering Maryland, Delaware, Virginia, West Virginia, North Carolina and South Carolina. This business was established in 1896. The company does a retail business, but makes a special feature of this, keeping it distinct from its wholesale department.

One of the real old line supply houses of the country is the Inter-Mountain Electric Company, Salt Lake City, Utah. This business was established eighteen years ago and covers Utah, Idaho, Nevada and Wyoming. Its retail business amounts to about $50,000 a year. The officers of the company are J. J. Daynes, Jr., president; W. P. Read, vice-president; C. B. Hawley, secretary-treasurer. Lafayette Hanchett and L. S. Cates are directors of the company. Mr. Hawley is also manager.

The H. C. Roberts Electric Supply Company, Syracuse, N. Y., is a branch of the Philadelphia house of the same name. This company carries about $40,000 worth of electrical material in stock at the Syracuse department. The company is a wholesaling concern exclusively, specializing in construction material. J. E. Greene is the manager, and the Syracuse house covers New York State.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

Opening of the Thirty-Fifth Convention at Seattle.

The special trains to the thirty-fifth convention of the National Electric Light Association arrived in good time at Seattle, Wash., on Sunday, June 9; and early on the morning of Monday, June 10, the bulk of the registration was complete. The excellent arrangements for taking care of the arrivals on the part of Secretary Martin and his staff facilitated the delivery of badges, information and papers, and left the entire day practically free for recreation or rest.

The baseball game between the Eastern and Western contingents, which was held on Monday afternoon, resulted in a victory for the Western team. The convention exercises began at 8:30 o'clock Monday evening with the formal opening of the exhibition of the class D members at the Seattle Armory. Among those exhibiting were the following: American District Steam Company, Benjamin Electric Manufacturing Company, Century Electric Company, Dalton Adding Machine Company, Copeman Electric Stove Company, Dearborn Drug & Chemical Works, Electric Storage Battery Company, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, *Electrical World*, Eureka Vacuum Cleaner Company, Federal Sign System (Electric), Fort Wayne Electric Works, Franklin Electric Manufacturing Company, General Electric Company, G. & W. Electric Specialty Company, Hubbard and Company, Hughes Electric Heating Company, Hurley Machine Company, H. W. Johns-Manville Company, Metropolitan Engineering Company, Minerallac Electric Company, National Electric Lamp Association, Otis Elevator Company, Pacific Electric Heating Company, Philadelphia Electric Manufacturing Company, Simplex Electric Heating Company, Wagner Electric Manufacturing Company, Waverley Company, Western Electric Company, Westinghouse Electric & Manufacturing Company, Weston Electrical Instrument Company.

The Commercial Section of the Association made a notable exhibit and added many new members. Practically every special train arriving at Seattle carried a full quota of members of the Commercial Section as the result of the activity of the Membership Committee en route.

Other impressive exhibits were made by the Meter Committee and by the Northwest Electric Light and Power Association, the Portland Railways, Light and Power Company and the Puget Sound Traction, Light and Power Company. At 9:30 o'clock Monday evening there was a reception in honor of President and Mrs. Gilchrist, followed by a promenade concert and dance. Assisting Mr. and Mrs. Gilchrist were Vice-President and Mrs. F. M. Tait, Mr. and Mrs. H. J. Gille, Arthur Williams, Mr. and Mrs. J. E. Davidson, H. H. Scott and Past-President W. W. Freeman.

Promptly at 10 o'clock Tuesday morning, President Gilchrist called the first general session to order, introducing George F. Cottrell, mayor of Seattle.

Mr. Cottrell offered the most cordial official and personal welcome to the Association, sketching briefly the growth of Seattle to its present population of 240,000. Seattle is one of the best lighted cities in the country, containing 1,106 five-light standards, 378 three-light standards and 137 one-light standards. There are also 700 arc lamps, a total of 830,000 candlepower of illumination over its 500 miles of residence and business streets. The city of Seattle believes that no better advertising can be secured than through liberal use of electrical illumination, not only because of its police value, but because of its comfort to the citizens and its attractiveness to the visitors.

President Gilchrist then delivered the annual presidential address, saying in part:

Another year has rolled around since this Association was last called to order by President Freeman in the Engineering Societies Building in New York City in May, 1911. It has been a year of growth and progress in the business of generating and distributing electricity, and of some development and fair outputs and sales in the kindred industries of manufacturing, selling, and installing electrical apparatus and wares. The National Electric Light Association has, we believe, kept fully abreast of this development, and its activities have been in keeping with the general activities of the business.

The advantages resulting from improved load-factor, which are everywhere admitted, have been impressed on recent administrations, with the result that Association work is distributed throughout the year to a much greater extent than was formerly the case. Then, few meetings of the Executive Committee were held and very little activity was noticeable until a few months prior to the annual convention. Now, a surprisingly large number of standing committees are appointed and at work in the early fall, and at least to the four or five hundred men in the work, either as members of committees, or officers of the main and affiliated bodies, the work appears decidedly and continuously active from one general convention to another.

Besides the reports submitted to the Convention, some of the committees have used the monthly *Bulletin* to excellent advantage in conveying advance information to the membership, and others have undertaken the compilation in handbook form of the detailed data and general information which they have gathered in the course of their investigations. This line of contemplations results in a full appreciation of the value of the committee work and the desirability of placing on the Association's committees the very ablest men in their particular branches of the business who are willing to give their time to the committee work, and to support them by placing at their disposal such reasonable funds as may be necessary to employ investigators and secretaries, and in other ways enable them by consultation and supervision to prepare and submit the most valuable reports possible. When eight or ten busy men of distinction in their branches are willing to give their time and thought to such conference, they are making most valuable contributions to the industry, and should be so assisted that no portion of the benefit will be lost.

Growth in Membership.

During the past year the growth in membership has been fair. There are those in the society whose opinions always have weight, who are inclined to question the advantage of continuing to expand the membership, but I believe a large majority of those who have given serious thought to the matter believe that it will be desirable to go on for a long time yet. There may be a few cases where the growth has been forced too rapidly, but for every case of this kind, there are a hundred where there has been no development at all.

Under the headway which it has obtained, class B membership will, I believe, continue to extend rapidly, not only as a result of the formation of company sections, but on account of the increasing desire on the part of individuals in the business to participate in the membership and get the advantage of the publications. The greatest effort, however, should be in increasing the company, or class A membership. There seems to be much difficulty in attracting to the Association the very companies which would derive the most benefit. Some way should be found to interest these people and show them that they can for a very small amount of money obtain advice and opinions along engineering, organization, and commercial lines, which would cost them many hundred times the membership fee if they went out to purchase such advice commercially.

It would be well to organize a state committee of 25 to 50 active men under a vigorous and enthusiastic head in each one of the states, the chairman of these state committees to form the general Committee on Organization of the Industry; then the eligibles in each state should be apportioned among the committeemen in that state, these committeemen to be given the authority to enlist the assistance of the company members in the neighborhood. In this way, by the personal work of the local people, it would be possible to largely increase the Class A membership. In addition to this organization, the time has come when the Committee on Organization should be authorized to employ a traveling representative of the Association, who should visit as many non-member companies as possible each year for the purpose of laying before them, personally, the advantages of membership; and receiving suggestions and criticisms.

The monthly *Bulletin*, with which you are all familiar, and which has become a feature of the Association, is growing yearly in importance. A most useful department of this bulletin is the Question Box. I would commend both the *Bulletin* and the Question Box to your very thoughtful attention.

Organization.

The plan of inviting State Associations to affiliate with the National Association is working out slowly. During the year the Northwest Association, comprising several of the states in this section of the country, the Michigan Electrical Association and the Iowa Association, have voted to affiliate and have been taken in. This movement is a little slow, but the results are satisfactory. The presidents of the different affiliated associations, as *ex-officio* members of the Executive Committee, have a voice in the management of the parent Association, and their respective associations become a part of the National in fact as well as in name and membership.

The time will come when the entire industry will in this way be brought together. The conventions of these affiliated associations stand high in the character of the work they do, and in many cases are as large as the National was a very few years ago. The fact that the attendants are generally very well acquainted with each other is apparently responsible for the most desirable kind of discussion, and leads to the query as to whether or not in the future the best literary and scientific work of the Association may be done in these state conventions; while the National will have become more of an executive meeting composed chiefly of the regular constituted delegates from the affiliated associations.

The scheme of the organization at present provides for company sections, state and geographical sections, and the parent association. The question has been raised as to whether or not there should be some form of section between the company section and the state association. The demand seemed to come principally from the desire on the part of companies in some of the larger centers to hold meetings which class D and E members, as well as class A and B members in a community may attend.

There has been much growth during the year in the company sections. There have been a few new sections formed, but the growth has been principally on account of the accession of a large number of members to the older sections. A considerable personal experience in the results in such sections leads the speaker to the conclusion that this work should be encouraged as much as possible.

In connection with the question of organization, I would call your attention to a recommendation made in 1909 by President Eglin in his opening address, which was that more vice-presidencies in the parent association be created. I wish to endorse this recommendation.

The income of this Association has naturally increased with the membership. The income at the present time from all sources is somewhat over $100,000 per annum but it is hardly ample for the necessities of the organization, as it is desirable to lay aside a certain amount each year for the purpose of accumulating a reserve fund. While a very large sum of money on a Reserve Fund may not be necessary or desirable, and may even prove an embarrassment, an association of the size of this one should have a fund of at least a half million dollars well invested which would insure an income over and above that derived from other sources of from twenty to twenty-five thousand dollars a year.

Another matter of live importance which should be shortly attracting the attention of the Association is that of a suitable and permanent building of its own. This would be very desirable as a means of securing the prominence which is necessary to enable the Association to carry out the purposes for which it exists, even if it were not necessary on account of the more practical reason of affording proper accommodations for the organization which has grown rapidly during the past decade and which, if it keeps pace with the industry, must go ahead more rapidly in the future. I know of nothing which would be more effective in giving tangible indication of the strength than such a move.

There are very many advantages in locating this in New York City, as that seems to be a point where it is possible to get men from all parts of the country to go with less difficulty than any other place, but the location of such permanent headquarters should be very carefully considered. A city nearer the present center of population might seem a more reasonable place from the standpoint of the entire membership; or, on the other hand, there might be very decided advantages, in line with a suggestion which has been made, of establishing our own building in the national capital.

Co-Operation.

The Association has in recent years given much attention to the desirability of the most cordial relations between the central stations and the manufacturers from whom they purchase, and all of the people following electrical pursuits.

There are a very large number of people in the country in our work who have apparently only recently awakened to the realization of the fact that there is a great mutuality of interest between all the people engaged in any way in electrical businesses. It is earnestly hoped by the speaker that the policy of this Association may be one of taking the initiative in the development of the closest union and most cordial feeling between the men and companies interested in all branches of electrical work.

This suggests another relationship which has not been cultivated in the past to the extent that it should be cultivated in the future, and that is the relationship between the National Electric Light Association and the various institutions of learning throughout this country. Not only is it important, from the standpoint of having men properly educated to prosecute the business and operate undertakings, to get in closer touch with the branches of such institutions that deal with the education of young men, but also it is desirable by more mutual acquaintance to get in a position to appreciate each other's points of view in order that the rising generation may have broad practical views regarding many of the great questions which are puzzling the country today; and particularly, fair views regarding the formation and operation of corporations—most especially, public-utility corporations. A standing committee on relations with institutions of learning would, in the estimation of the speaker, be most desirable.

Public-Service Commissions.

Still another relationship which it would be desirable for this Association to cultivate would be one with the public-service commissions of the country. Such relationship would be best handled by, or under the direction of, the Public Committee, but it is a matter of decided importance. While at the present time comparatively few of our states have established such commissions, they are increasing yearly in number. It is fair to conclude that the men on these commissions are earnestly desirous of arbitrating fairly between the public utilities over which they are given authority and the people, but they naturally lack experience, and this Association, without compromising its position as the bulwark of the rights of the central-station business, should maintain toward the commissions an attitude of cordial and friendly co-operation in arriving at what is right and fair in relations between public-service corporations and the public. It should at all times be the aim of our Association to promote harmony and good feeling among all of the interests in our business, thereby obtaining the strength of real unity, and the protection of the Association should be extended particularly to the owners of small properties which may be involved in difficulties which are trying to their resources. However, in this connection attention should be given, where cases come to our notice, to the methods of small companies, and any practices which are not consistent with the established ethics of the business should be vigorously frowned upon.

Municipal Ownership.

The tide of public opinion with regard to this question seems to ebb and flow. Six or seven years ago it seemed to be at the flood point. This was followed apparently by a decided revulsion of approval to municipal ownership of utilities, but recently the municipal idea seems to be again becoming more popular. Political expediency, and self-interest of a certain proportion of the public, will probably always be decided factors in this discussion, but these elements should be overcome and the question should be dealt with from the standpoint of the "greatest good to the greatest number" of people, and if this problem is taken up intelligently, I believe it can be shown that under the conditions existing in the world today, and particularly in this country, better service can be rendered at the same price, or the same service at a lower price, in all branches of public-utility work, by privately owned corporations as compared with municipally owned ones. The difficulty which confronts us is that of making an intelligent comparison.

Apparently at the present time one decided cause of the increase of municipally owned plants is that many short-sighted owners of small properties, who have themselves not been able to operate successfully, have deliberately gone into the business of unloading their properties on the municipalities. Another important element in the increase of small municipal plants is the fact that in many small towns those in charge of the water works are using their influence to have electric plants established in connection with the water plant. This in

itself is no doubt fundamentally economical, but far-sightedness on the part of central-station people should result in the matter being arranged so that the privately owned company would take over the operation of the water system, or at least should provide the power for doing the pumping. Centralization of every supply is in the direction of economy, and no central station should rest while there is any possibility of extending that centralization.

Electrical Rates.

This Association has for two years past had a committee making a careful study of electricity rates. The question of rates is one which has occupied a great deal of the attention of electrical people since the business was inaugurated, and while rate schedules have been established very generally, which on analysis are quite similar in results, there is a deplorable lack of uniformity in the schedules themselves.

The question of rates is naturally one of paramount importance in the eyes of the public-service commissions. At the present time these commissions are in many instances studying the question and have not felt sufficiently sure of their position to take any very radical steps, which is a very rational and conservative view, but the time is close when, on the initiative of the companies which form this Association, uniform rate systems must be put into effect. I especially commend to the attention of the convention the report of this year's committee.

A growing amount of attention has been given during the year to the desirability of protecting and making more secure the good name of central-station securities. The importance of this to the continued growth of the industry needs no exploitation. On the whole, the electric light securities of the country have a very clean record and this should be very jealously guarded by the Association and everyone in it. No corporation or group of men should, without the protest of this Association, be allowed to push the promotion of businesses to a point where a halting or recession in general business will result in losses which may have serious effect on the whole fabric of electrical investments.

Welfare Work.

Stimulated by last year's report of the Public Policy Committee, a great deal of interest has been shown in plans for adding to the welfare of central-station-company employees. Employees' clubs, savings and investment plans, pension schemes, athletic events, entertainments, the attendance of physicians and visiting nurses, and similar arrangements for adding to the health, pleasure, and general welfare of the employees are becoming yearly more common.

Somewhat in line with this class of work the Association has been fortunate this year in being instrumental in obtaining the appointment of a body known as the Resuscitation Commission. The object of this commission is to study the effect of electrical shock on the human system in order to treat more intelligently and successfully cases of this kind; also to revise and prepare for publication rules and diagrams which will result in the application or first-aid methods in accordance with the most up-to-date practice. While modern precautions and safeguards have decidedly reduced the number of cases of this sort in proportion to the increase in the use of high-tension energy, it is universally admitted that no effort should be spared to hold the loss of life at the lowest possible point.

In concluding this address I would particularly commend the policy of the Association in taking the initiative, from the standpoint of good business, as well as good ethics, in urging upon its members the adoption of the most modern ideas of broad and fair relationships between public-utility companies and the public. This is no new idea in highly competitive lines, where an undertaking is bound to succeed or fail, depending directly upon the acceptability or lack of acceptability of its service to its patrons. Great merchandising concerns have always recognized this truth, and much more should it be recognized in the cases of public-utility corporations dealing with a public, who, as contributors of certain rights and benefits vital to the conduct of the business, become in a sense partners in the business; and for this reason, and also because of the factors which determine that in the interest of economy our business should be a monoply, have a right to expect much greater consideration than would be the case in private enterprise. If this Association can hasten the adoption of broad and intelligent policies in the conduct of the business by all of its member companies, it will have accomplished a work of sufficient importance to the success of the business to have paid for its existence if it never accomplished anything else.

Vice-President Tait named W. C. L. Eglin, of Philadelphia; J. E. Davidson, of Portland; R. H. Ballard, of Los Angeles, as a committee on the President's Address. John A. Britton, senior vice-president of the Pacific Gas & Electric Company, San Francisco, was introduced. Mr. Britton, as an enthusiastic Californian, and as a director of the Panama-Pacific National Exposition Company, made a stirring and eloquent address inviting the Association to hold its convention in San Francisco in 1915.

Mr. Britton's remarks were greeted with prolonged applause and President Gilchrist said that while it was too early to make definite plans, the invitation from San Francisco would receive the careful consideration its cordiality entitled it to.

P. H. Scott, chairman of the Membership Committee, reported 12,084 members: Class A, 1,134; Class B, 9,725; Class C, 45; Class D, 240; Class E, 940.

Secretary T. C. Martin described the work of the executive offices and outlined the needs for additional room, members of staff and income to adequately handle the increasing work of the Association.

W. W. Freeman introduced a resolution, which was unanimously adopted, instructing the secretary to forward to Past-President Louis A. Ferguson, Chicago, the greetings of the convention, regret at his inability to be present and joy at the report of his convalescence.

The report of the insurance expert was presented by W. H. Blood, Jr. There has been greater co-operation upon the part of operating companies and underwriters, with improvement in rate revision and lowering of rates. The consolidation of many properties, the abandonment of old stations and new construction are eliminating the fire hazard. There is much work yet to be done. Liability insurance is in a chaotic condition and workmen's compensation acts now going into effect in several states will materially affect this situation. Rules presented by Electrical Committee of the National Fire Protection Association, and which have been recommended for approval at the meeting in March, 1913, will make it mandatory to ground secondary alternating-current circuits up to 150 volts and grounding will be permissible at higher voltages.

The report of the Committee on Progress was presented by Secretary Martin, who explained the character of this report and outlined the change of form which has taken place from year to year. This year the report is in two sections, one dealing with general progress, and the other dealing with progress in power transmission.

There was no report forthcoming from the Library Committee and the Handbook Committee. The report of the Committee on the Question Box was presented by E. A. Edkin, editor. As the Question Box will hereafter be handled at the executive offices under the direction of the secretary, the committee made several recommendations, particularly with reference to a revision of classification. Mr. Edkins recommended the adoption of the Dewey decimal system of classification, or a system similar.

W. H. Hodge presented a short communication prepared by the librarian of H. M. Byllesby & Company, outlining the adaptation of the Dewey decimal system of classification to the Question Box. These recommendations were concurred in by I. H. Jackson, of Mobile; J. B. Seaman, Philadelphia; Homer E. Niesz, Chicago; R. H. Ballard, Los Angeles, and Farley Osgood, Newark. Mr. Jackson suggested the appointment of some one with a wide experience in the classification of a topical index. Mr. Niesz called attention to the great increase in the efficiency of the Question Box through its publication in the *Bulletin* monthly.

Mr. Ballard stated that at Los Angeles one man had been selected to study all questions in the Question Box and make particular effort to answer questions. This man had become one of the most enthusiastic boosters for every line of effort of the Association, and had so increased his own and the company's efficiency that he was the recipient of special recognition on the part of the company.

Mr. Osgood suggested that company members inform the editor of the Ques-

tion Box of the men in their companies available for the answering of questions of a certain character and thus stimulate interest in the status of this important medium of information. A short communication from John C. Parker, a former editor of the Question Box, was read by Secretary Martin.

The session concluded with the paper entitled "Expanded Loyalty," by Paul Lüpke, which was read by Secretary Martin.

Commercial Section.

The first session of the Commercial Section was opened shortly before three o'clock Tuesday afternoon by Vice-President F. M. Tait, who presented H. J. Gille, chairman of the Commercial Section. Mr. Gille outlined the work of the section and described the publications that had been published by the section for distribution to the electrical industry. He called special attention to the establishment of a central bureau at New York, under the direction of P. S. Dodd, secretary of the section, who, through the courtesy of the National Electric Lamp Association, had maintained this office and given his time without expense to the section.

E. W. Lloyd moved the appointment of a committee to take action on the address of the chairman, and Vice-President Tait appointed on this committee J. Robert Crouse, Cleveland; T. I. Jones, Brooklyn, and E. L. Callahan, Chicago.

Mr. Gille then took the chair, introducing W. W. Freeman, of Brooklyn, who addressed the meeting on "The Commercial Development of the Electrical Industry." Mr. Freeman drew attention to the fact that it was not until 1902, after the Association had been meeting for 16 years, that the commercial development of the industry was specifically mentioned in the president's address. At that time Henry L. Doherty had said that he believed that within five years the members of the Association would forget about engineering problems in their eagerness to develop commercial methods for disposing of the energy generated. Mr. Doherty also said that at that time central stations were selling only 30 per cent of their capacity, that while selling electricity was on a retail basis, the time was coming when it would be on a wholesale basis; that there was no reason why electrical energy should not be used for every form of motive power in every kind of industry.

Mr. Freeman sketched briefly the old-fashioned ideas that had prevailed and said he believed that the present development was largely the result of the increased demand for more light and better facilities. Complete systems were now available for using all the energy the central stations could produce. In the future the largest measure of success and profit will come from the ability which the central stations put into their commercial development. He said that three things must be taken into fundamental consideration: (1) The large investment, and the slow turning over of the capital account. Every year a large proportion of the earnings must go to pay interest upon the investment. (2) There is a small proportion of the output compared to the maximum demand. The central station must stand ready to furnish maximum service whenever called upon and it has little control over the demand. (3) A large proportion of business connected up is essentially unprofitable. There is no way to avoid a certain amount of business which costs more than the central station can collect. He exhibited two slides showing how the maximum demand affected the load-factor, and how costs could be materially reduced if certain classes of business could be arbitrarily eliminated. The big problem of the Commercial Section was the improvement of the load-factor. This had been accomplished in some localities and he believes that there is ability enough in the commercial men to make this condition universal.

George Williams, of New York, not being present because of illness, P. S. Dodd presented a brief report on the methods of the Commercial Section. He described the three publications which had been prepared this year, one on "Industrial Lighting," with an edition of 1,000 copies; one on "Residence Lighting," with an edition of 2,000 copies, and one on "Decorative Lighting," with an edition of 500 copies.

Efforts were being made to have a co-operative movement carried out by a committee from the Electrical Supply Jobbers' Association, the National Electrical Contractors' Association, and the manufacturers of electrical apparatus. A commercial index was being prepared and this would be of invaluable reference value for information relating to the utilization of current-consuming devices. It was recommended that the incoming administration of the National Electric Light Association appoint a committee to co-operate with the Commercial Section in its development work.

The report of the Committee on Steam Heating, in the absence of S. M. Bushnell, of Chicago, chairman, was read by A. D. Spencer.

E. W. Lloyd, of Chicago, opened the discussion. He particularly condemned the method of selling steam on a flat-rate basis and said that when the winter was particularly severe the result was disastrous to the supplying company unless steam was sold at meter rates. There was a great possibility in the sale of steam if the business were secured on the proper basis, although in some cases concessions had to be made in order to secure the lighting and power business of large users of steam for heating and other purposes.

R. D. Wolfe, of Rochester, advocated charging on a basis of pounds of steam used per hour rather than on radiation per square foot.

The report was also discussed by T. I. Jones, of Brooklyn; Egbert Douglas, of Milwaukee; W. H. Lyons, of Portland; and the general consensus of opinion was to the effect that estimates with relation to steam consumption for heating were generally unreliable and more safety lay in charging on a meter basis.

The session closed with the reading and a short discussion of the report of the Committee on Electrical Refrigeration and Ventilation, which, in the absence of John Meyer, of Philadelphia, chairman, was presented by C. A. Graves, of Brooklyn.

The second session of the Commercial section was held on Tuesday evening, Mr. Gille presiding. Ward Harrison, of Cleveland, read the report of the Committee on Competitive Illuminants, in the absence of Chairman F. H. Golding.

The Committee on Industrial and Commercial Lighting, E. H. Beil, chairman, presented its report in bulletin form. The report of the Committee on Electric Advertising and Decorative Street Lighting was postponed until Wednesday.

The first session of the Power Transmission Section was opened at 9 o'clock Tuesday by Henry L. Doherty, chairman. Mr. Doherty's terse characterization and forceful arraignment of alleged conservationists and misinformed obstructors aroused the big audience to a high pitch of enthusiasm. Following the chairman's address, which will be printed in full in a later issue, a paper by C. H. Williams, on "The Use of Electricity for Irrigation and on the Farm," was presented. In the absence of Mr. Williams this paper was read by A. W. Hahn, of Denver. The reading of the paper was supplemented by moving pictures and colored stereoptican slides. So great an interest was manifested in the reading that the session was prolonged until close to midnight. Participating in the discussion were Chairman H. L. Doherty, Samuel Insull, John A. Britton, R. H. Ballard, P. Junkersfeld, J. E. Davidson, J. H. Doulan, C. W. Pen Dell, D. F. McGee, H. S. Wells and J. C. Hayes. A review of this paper and the discussion will be published in an early issue.

Sessions were held on Tuesday by both the Accounting and Technical Sections. The program, which provided for sessions morning, afternoon and evening on Wednesday and Thursday, was concluded with a rejuvenation of the Seattle and Tacoma Jovians on Thursday evening. On Friday the whole convention party visited Snoqualmie Falls as guests of the Puget Sound Traction, Light & Power Company.

A full report of the other sessions will appear in our next issue.

FOLLOWING UP CONSTRUCTION JOBS IN A CENTRAL-STATION COMPANY.

Alden W. Welch.

In directing engineering installations the highest efficiency can be obtained only when things are moving smoothly. One step should follow another without unreasonable time intervals between them. When a substation is to be erected and equipped several departments of the central-station company are involved and it is imperative that the work of none of them be held up by any of the others.

With the organization usual in a great lighting and power corporation, the department first interested in a new development is the engineering. The function of this department is to design the station, preparing all drawings and specifications. These are sent out to the contractors for estimate. Contract is then entered into with the successful bidder and the work supervised.

Before, or during the erection of the building, the electrical equipment is laid out and the apparatus ordered. Drawings are prepared showing the location of all machines, regulators, switchboards, feeders, etc. Material lists are prepared from the drawings and indicate what material is to be ordered by each department.

A complete set of these drawings are sent to the department of electrical construction, and a receipt obtained for them. This latter department is responsible for the installation of all electrical apparatus and checks it up upon delivery. It orders the angle iron, bolts, nuts, etc. In the case of small jobs, such as the addition of several panels to an existing switchboard, it buys all the material except the instruments which are ordered by the engineering department.

The first inter-departmental hitch can, therefore, occur through the failure of the engineering department to deliver the drawings and material lists to the department of electrical construction promptly. There are many chances for slips up and delays in a job involving as much detail as the construction and equipment of a substation.

It is therefore desirable to originate or select some good workable scheme for following up the principal issues of the entire job. There is given herewith a method that has proven satisfactory, and one that will fill the bill for most companies. It is a table that shows the progress of the work, and is, in fact, a complete history of the vital parts of the job.

The dates for the second column are supplied by the chief mechanical draftsman. The third date is found on the contract. The inspector's daily reports will show when the actual construction work was begun and finished. The chief electrical draftsman will tell when the electrical construction drawings were ready. The machine and switchboard orders or contracts, as the case may be, will indicate when they were ordered, and the shipping memoranda will state when they were shipped. The date of installation of the machines and apparatus may be obtained from the department of electrical construction. The drawings will be required by this department in time to commence work as soon as the station is sufficiently tenable.

By keeping alert the various features of the job can be made to mesh and progress smoothly. After a certain job is authorized the plans and specifications should be prepared as soon as possible as it is much more efficient to push the drafting straight through to completion than to make it a discontinuous or intermittent function.

When the drawings and specifications are sent out for estimate they should be accompanied by a letter stating that the bid should be sent in on a given date. This should be followed up in order to insure promptness. After the construction is started the inspector of the engineering department should turn in daily reports giving the work accomplished for the day. During this time the electrical equipment should be ordered, insisting upon its delivery at such time that it is estimated that the station will be tenable, such as two months from receipt of order. The electrical drawings and material lists and copies of orders should be sent to the department of electrical construction as soon as possible so that they may be prepared to do their part.

Station and Jobs	Mechanical Drawings Ready	Contract let	Work Started in Field.	Work Completed	Electrical Drawings Ready	Machines			Switchboards			Drawings Required by Electrical Construction Department.	Job Completed
						Ordered	Shipped	Installed.	Ordered	Shipped	Installed		
Substation "A"	7/8/10	8/2/10	7/25/10	2/5/11	7/15/10 8/1/10	Rotary 7/19/10	9/20/10	10/15/10	7/20/10 7/30/10	7/30/10 8/25/10	9/1/10 3PH. 9/25 in. D. C.	8/1/10 "	
Gen. Sta. No. 1 Foundations for No. 3 Turbine	7/20/11	8/10/11	8/10/11	2/5/12									

Large Hydroelectric Plant at Austin.

Material is being assembled for the construction of the big dam across the Colorado River at Austin, Tex., which is to furnish initial power for a large hydroelectric plant, besides creating a pleasure lake that will run back for thirty miles in the hills. The new dam will occupy the same site as the old one which was washed away by a flood twelve years ago. The franchise for the dam and hydroelectric plant is held by the City Power Company of Hartford, Conn., which has let the contract for the construction of the works to the William P. Carmichael Company of St. Louis, Mo. Under the provisions of the franchise the city of Austin is to pay $1,720,000 for the dam and appurtenances. Of this sum, $100,000 are to be paid on completion of the contract and the balance in fifty semi-annual instalments of $32,400 each. The whole sum is to be paid out of the earnings of the municipal water and light plant and no tax levy or bond issue will be made to meet the cost of the works.

Besides constructing the dam and electric power station the contract calls for the construction of a 10,000,000-gallon reservoir among the adjacent hills. Two 6,000,000-gallon pumps will be installed. It is stipulated that the hydroelectric plant shall produce a minimum of 600,000-horsepower hours of energy in every thirty-day period. During all but the dry season the output of power will be much greater.

New England Pension Plan.

The New England Telephone & Telegraph Company has announced a pension system which will be put into effect on July 1. After 20 years of service an employee may be pensioned for disability at the age of 60; at 65 he may retire upon a pension at his own volition and at 70 retirement is compulsory. The minimum pension is $25 per month and the maximum is $100.

ILLUMINATION OF A MASONIC HALL.

By G. T. Hadley.

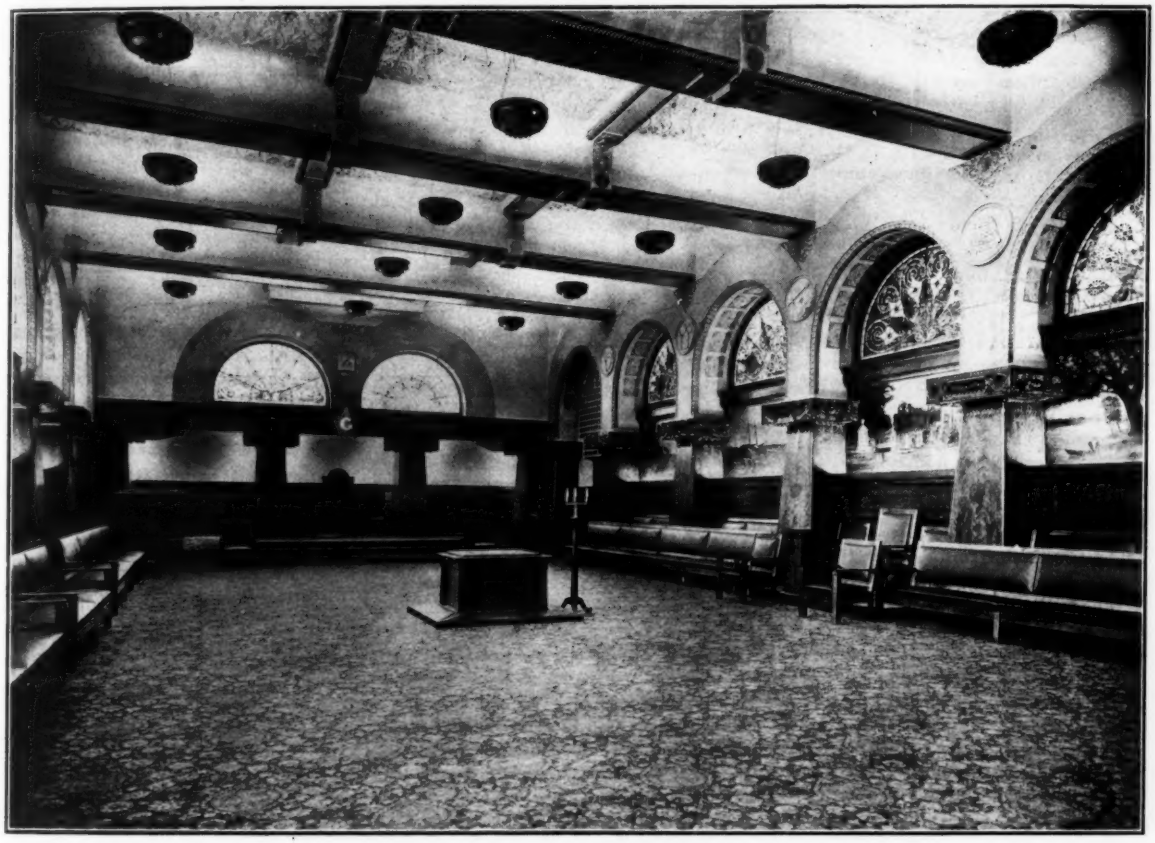
The new Masonic Hall in the Auditorium Hotel, Chicago, Ill., occupies the Egyptian room formerly used as a banquet hall, where the lighting facilities comprised 560 56-watt carbon lamps. Ten electric fixtures with 35 lamps to a fixture, about 100 lamps under the balcony and 75 above, made a great glare, but not a satisfactory or entirely efficient illumination. This old Egyptian room is one of magnificent proportions, 85 feet by 40 feet with 22-foot ceiling. F. A. Vath, illuminating engineer for the hotel company, undertook to remodel the room and make it over with due consideration for the efficiency and efficacy of illumination as important factors of the work.

The room was already reminiscent of Egypt, with stately columns of polished birch surmounted by hand-carved capitals, and between the capitals 13 oil paintings. Each painting has been effectively illuminated by three 20-watt concealed lamps. Eighteen art-glass windows presented a problem which was successfully solved by placing a direct lighting unit behind each window at the proper angle, so that the art-glass patterns become distinctly visible. From the 21 stucco panels of the ceiling, 21 indirect lighting fixtures were suspended, each unit containing one 100-watt tungsten lamp with reflector. In the east end of the hall above the chair of the Grand Master is the usual blazing star and the letter G, equipped with one 25-watt lamp. There are no exposed lamps in the hall except the altar lamps mounted on a tripod beside the altar in the center of the room and these lamps have frosted globes. The 21 indirect lighting units, the lamps illuminating the paintings and all others in the room are under the control of a regular theater dimmer. In a hall fitted up like a temple with all lights under perfect control, the adminstration of the American rites to an "entered apprentice" must be remarkably impressive and awe-inspiring. Additional auxiliaries in the way of an organ of superb tonal power, a stereopticon machine for the projection of pictures, combined with the wonderful psychological effect of the illumination, are well calculated to impress the candidate during the ceremony of initiation.

In this instance, the ancient "mysteries" have been most skilfully supplemented by modern scientific illumination. The lighting system has been worked out with a view to effects rather than foot-candle intensities. The light is so soft and diffused that the effect produced is one of absolute peace and restfulness. The hall is already so popular with the lodges that it will soon be in use every night of the week and will yield a probable rental of some $10,000 annually. There are no shadows, and it is possible to read ordinary print at any point in the room, yet the illumination is so efficient that a considerable saving of energy has been effected.

The change throughout the hotel from the old system of lighting makes a saving of 58 per cent in power consumption. Three years ago the electric-light load ran from 75,000 to 80,000 kilowatt-hours monthly; now it runs from 35,000 to 42,000 kilowatt-hours. There is less expenditure of power than ever before but better illumination.

The lighting system may be considered one par excellence because the illumination is soothing to the eye and the lighting units harmonize with their environment. The impression created is one of high mental appreciation for the effects produced while the efficiency of the illumination is of the highest order consistent with other considerations and the system permits of economic maintenance.



Location of Lighting Units in New Masonic Hall, Chicago.

The Paths of Progress.

The universal blessings of cheap electricity for every purpose that involves the employment of energy, apart from the conscious human touch that starts the engine or fills the kettle or switches on the lamplight, must wait upon the release of the electrical industry from parochialism and from narrow-minded over-regulation.

There appears to be no department of mankind's activities in which electricity cannot be advantageously introduced. Every house and every factory in the land ought to have cheap energy by wire, to do away with drudgery and dirt, and to enrich the people with better health, longer life and a brighter and fuller life while it lasts.

According to a recent experimenter even our children may be stimulated in their growth and intelligence by being put to bed with high-frequency current playing round their cots. There are many miracles that are as yet only dreamed of, waiting for a more enlightened policy to become commonplace daily experiences.

Meanwhile, it is a very dull and decorous trade that is carried on in electricity. For the most part it is the perfunctory selling to the indifferent. There is no sign on either side that electricity is considered to be anything more than a competitor with gas, and its price is haggled over without any thought of what immeasurable potentialities of service to humanity are only deferred because suppliers and consumers and the general public do not bestir themselves to decide that they will have these benefits for themselves and not leave them all for posterity.

What the trade can do is to advertise electricity more vigorously and more enthusiastically than has ever yet been done. What the public can do is to keep the trade busy and to use electricity without such a grudging of pence as it has to put up with. Because the more is used the cheaper will the general supply become, and the easier it will be to wire every house for a full domestic service, saving in labor, in health, in time and temper, and contributing largely towards making life worth living.—*Electrics.*

Appraisal of Kansas City Railways.

B. J. Arnold, of Chicago, and Mortimer E. Cooley, of Ann Arbor, Mich., have been appointed to make an appraisal of the street-railway properties in Kansas City, Mo., and in Kansas City, Kans. The appointments have been made by United States Circuit Judge William C. Hook, who has charge of the receivership. The results of the investigation and appraisal will be used in negotiations for a new franchise.

MISSISSIPPI ELECTRIC ASSOCIATION.

Report of the Fourth Annual Convention at Vicksburg.

The fourth annual convention of the Mississippi Electric Association was held in Vicksburg, Miss., May 28, 29 and 30, 1912. The attendance was about the same as at last year's convention, a total of 106 being registered.

In planning for this convention the Executive Committee early determined that this should be a working convention, and with that in view, arranged that every class A and class B member should be engaged during the entire three days' session. The entertainment features which were provided took place at such hours as would not conflict with the regular sessions.

The convention was called to order at 9:30 a. m. on Tuesday by Vice-President R. B. Claggett, who explained that President Abbott would not be in attendance on account of his removal from the State. Mr. Claggett then introduced J. J. Hayes, mayor of Vicksburg, who welcomed those in attendance. He related the interest he had always felt in electricity from the time when, as captain of a Mississippi River steamboat, he made use of the first electric searchlight for the purpose of locating landing places along the river banks. At first the pilot objected to the new light, but gradually its use became more and more general and now it is used universally.

Vice-President Claggett gracefully replied on behalf of the Association and then proceeded to read his address as acting president. He dwelt on the work of the past year and outlined the history of the Association since its organization in Jackson, June, 1909. The early membership was small and at first but little enthusiasm was manifested. A few realized the benefits to be derived from such an organization and by constant effort have seen the membership increase until now it compares favorably with similar organizations elsewhere. The program for this convention, he explained, was selected with care and should arouse the interest of every member. The question box, as a means of activity for all the members, should be one of the important works of the Association. Current questions could be handled to better advantage, useful data placed in hands of members and its facilities would serve for communication between members. He expressed his thanks to the editor, C. E. Reid, for his untiring efforts. Speaking on standardization of accounts, he said that a committee should be appointed to consider the adaptability of the forms prescribed by the National Electric Light Association. Should times come when member companies are subject to rulings of a public-utility commission, they should be in position to convince it of the practicability of the forms recommended. Regarding proposed legislation, he stated that the electrical industry had developed so rapidly that central-station managers have had no time to watch legislative matters, resulting in a condition which poorly protects the interests involved. A number of important laws should be enacted, among which is one dealing with the theft of current, making the presence on any premise of any appliance or other device for the purpose of deflecting flow of current, *prima facie* evidence, putting burden of proof on the occupant of the premises. On account of neglect of legislative matters, much unreasonable legislation is often proposed. During the past year the central-station interests of the State were subjected to the results of an agitation coming from an indefinable source, having for its object, the creation and establishment of laws and commissions which would regulate and control the business of the central stations, and some bills introduced were no less than confiscatory. The Executive Committee appeared before the Senate Judiciary Committee of the Legislature and discussed thoroughly the merits and demerits of the proposed legislation. The results achieved were beyond the Executive Committee's expectation, but had it not been for the concentrated effort on the part of this association, the central stations of the State would, in all probability, be subject to rulings of a commission whose members would be unfamiliar with the subjects in hand. "We do not oppose a public-utility commission," he said, "but demand one free from politics, with adequate legislation protecting the interests at stake so that business can be carried on in peace." He commended the practice of frequent meetings of the Executive Committee.

Following this address, the first paper on the program was presented by H. W. Young, who explained that the author, R. C. Lanphier, was unavoidably detained.

Induction Meters.

The author traced the development of the induction meter from the original discovery of the rotating field by Ferraris. The different forms of meter which have appeared on the market were mentioned and their characteristic features were explained. Following the expiration of the Tesla and Shallenberger patents, a number of new induction meters have been brought out during the past year. The various meters now on the market have many points of similarity but each has particular features for which advantages are claimed. The differ-

ences between these meters were explained in detail. It was also stated that the methods of testing meters before shipment had gradually improved during the last few years, so that now the meters obtained from manufacturers are usually within the limits of accuracy guaranteed. The watt-hour meter is an element of vital importance in central-station operation, and much depends upon the proper care and inspection of meters.

This paper was listened to with a great deal of interest, and was discussed quite fully by C. E. Reid and H. W. Young.

Professor Reid dwelt on the great and sustained accuracy of induction meters, citing some tests made at the Bureau of Standards at Washington, a number of years ago.

Mr. Young pointed out that the expiration of certain patents had opened the door to meter designers, and the present lower-price meters were the result. He stated that further reductions are not probable, that the central stations demanded a high degree of accuracy and on this account the overhead charges of the manufacturers were high.

A. H. Jones pointed out that the central stations are not entirely responsible for the demand for accurate meters as the consumer exerts considerable influence. This consumer is jealous of the treatment received and nothing but a meter of the highest accuracy will satisfy him.

At the afternoon session a paper was presented on "Grounding of Secondaries," by J. T. Robertson.

Grounded Secondaries.

The recent action of the National Fire Protection Association in requiring the grounding of transformer secondaries of distributing systems where the maximum difference of potential is not over 150 volts was referred to by the author and the practice thus laid down was advocated. When the possibility of damage suits is considered, the cost of grounding should not be an obstacle to the adoption of the grounded system. The system of grounding that is preferable depends upon local conditions. Connection to a water-pipe system is to be preferred, but where this is not possible a rod or pipe should be driven into the ground to the depth of permanent moisture, and connected through a No. 6 or larger wire. A ground should be made about every 250 feet. When changing over an old system, thorough inspection of all outside lines and inside wiring should be made and any objectionable features removed. Connections can then be made to ground through a transformer fuse block, and after all grounds have been made the fuses may be replaced with copper wires. The grounding of secondaries is not only a protection to life, but also to property in case of a cross between high and low-potential circuits. The grounding should be thorough to be effective.

This paper was discussed by H. W. Young, C. E. Reid, S. M. Jones, T. B. Cabell, A. H. Jones, R. B. Claggett, and W. H. Harvey. This discussion brought out the fact that grounding of secondaries is a source of much worry to all companies. The expense of the ground connection, also of the inspection, and the troubles from defective installations and grounds in trees were gone into thoroughly. H. W. Young pointed out that in some cases a spark gap interposed in the ground circuit would avoid the troubles due to poorly insulated systems, and would protect from high voltage.

The report of Secretary and Treasured referred to work of the Executive Committee before the Legislature. A committee was recommended to gather information and statistics on public-utility-commission matters and also to draw up a recommendation of a public-utility bill, patterned after the best features of the laws of other states, so that the data and recommendations can be submitted to the legislature when the subject becomes active again. Experience proves that it is too complicated to be handled properly in the hurry of a legislative session. It was suggested that committees be appointed on Public Policy, Line Construction, Insurance, Public Utility Laws, Meter Practice, Electric Heating and Cooking, Electric Vehicles, and Grounding of Secondaries. Reports of such committees would be an annual statement of the condition and progress of each in the State. Criticisms of National Electric Light Association reports could also be embodied in these, pointing out to members wherein local conditions demanded variations from the national recommendations. The affiliation with the National Electric Light Association was called to the attention of members and the necessity for a change in membership classification to conform with the National Association. A reduction in revenue would result, but the individual members would gain. Exchange of publications with other state associations was considered a good way to gain acquaintance with conditions elsewhere and the suggestion made that the future might see all state proceedings published with the National Association proceedings in one set of volumes.

A reception to members and guests was tendered at the Carroll Hotel at 9:00 in the evening. This was a brilliant affair and much appreciated by the Association. Punch and light refreshments were served. A spirit of getting acquainted prevailed.

The second day's session was called to order promptly at 9:30 a. m. The first paper, "Distributing Transformers," was read by T. A. McDowell, who explained that the author, A. D. Fishel, was unavoidably detained.

Distributing Transformers.

This paper discussed the construction and operation of distributing transformers and the best methods of location and operation. Voltage regulation, continuity of service and protection of the apparatus from injury are the principal considerations to be borne in mind. It is often desirable to run a high-voltage feeder to a point where the load available does not in itself justify it, as a demand for power will usually be developed along the line. Single-phase transformers are usually preferable to three-phase transformers until the larger sizes are reached and a balanced load is available. The improvement in consruction and performance of distributing transformers during the past few years was emphasized. In order to get good regulation, automatic feeder voltage regulators are desirable. While the expense does not seem justified in some cases it will usually be found that the increased consumption of energy due to the maintenance of voltage during the period of peak load, and the saving in the burning out of lamps will soon replace the expenditure. The induction type of feeder regulator was described, along with the relays used in conjunction with it.

This paper was discussed by H. W. Young, W. F. Cox, A. H. Jones, and W. F. Gorenflo.

The next paper was read by G. S. Merrill, on "Electric Service Rates."

Electric Service Rates.

A proper and equitable rate will do more than anything else to secure the good will of a community, and consequently the greatest stability of the central-station investment. A good rate system is the best advertisement a station can have and a valuable asset to the new-business department. The author considered the different forms of rates which had been used, stating that the general level of charges should be adjusted to yield a reasonable return on the investment. He distinguished between the small lighting service and the large lighting-and-power service. Customers in the latter class can more easily understand the elements entering into the cost and seldom object to separate charges for overhead expense and operating expense. An example of such a charge was given, in which there was a graded fixed charge per kilowatt and a graded meter charge per kilowatt-hour. It is desirable also to vary the rate slightly according to the power-factor, the maximum-demand charge being increased in the inverse ratio of the average measured power-factor to a fixed power-factor, which may itself be made dependent upon the customer's load. The time interval over which the energy consumption is to be averaged in determining the maximum demand was then discussed. This value is usually 15 or 30 minutes, but a more elaborate schedule is sometimes adopted, in which the greatest of any of the following values is used: 60 per cent of maximum instantaneous peak, 80 per cent of maximum five-minute demand, 100 per cent of maximum 60-minute demand, etc. The form of rate which is very generally approved for small lighting service consists of a graded meter rate, where the primary charge is applied to the first 30 hours'

use per month of the maximum demand, and a secondary and sometimes even a tertiary rate for consumption in excess of this amount. There is usually specified also a minimum bill per month. Where the installation of a maximum-demand meter is not justified the demand may be determined by the general average on the system, by applying a fixed wattage per socket, by the connected load, by the floor area of the illuminated rooms, or by the number of rooms lighted. The author favored the latter methods in which service rendered rather than the actual demand was made the basis of charge. He also favored a flat rate for very small installations.

Discussions on this paper were offered by T. J. Duffy, John S. Black, C. E. Reid, P. Stern, W. H. Sparrow, W. F. Gorenflo, A. H. Jones, and S. M. Jones. This paper was one of the most interesting presented during the convention, and the discussion developed the fact that much thought was being devoted to the subject.

T. J. Duffy thought it would be hard to explain a multiple-rate system to customers. John S. Black cited his personal experience as satisfactory in New Orleans, where the change had recently been made from a straight kilowatt-hour charge to a multiple rate.

W. F. Gorenflo thought the only excuse for the straight kilowatt-hour rate was its simplicity and doubted the success with any other, especially where many foreigners were customers. Professor Reid cited a personal experience with a similar rate.

S. M. Jones asked for a rate which would permit the use of electric cooking appliances on the lighting meter.

A. H. Jones suggested a rate of such flexibility that it would be adaptable to all conditions and pointed out that such a rate could be offered as an option to customers who complained or were dissatisfied with old rates. Gradually the new rate would attract attention and win favor and eventually permit the discontinuance of the old rate.

After this paper an illustrated paper on "Modern Street-Car Construction for Small Cities" was presented by George L. Kippenberger and W. L. Alt, of the St. Louis Car Company. This was a very elaborate paper and entered into considerable detail. It was discussed by A. J. Carter, W. B. Moorman, I. H. McArthur, W. L. Alt, and G. L. Kippenberger.

At the afternoon session the nominating committee was elected to make nominations for officers for the coming year, after which the meeting adjourned and many members enjoyed an automobile ride through Vicksburg National Military Park and Cemetery. Vice-President Claggett also entertained Harold Almert of Chicago, representing George H. Harries, with a trip through the Park. At 6:30 p. m. the Executive Committee and their wives entertained Mr. Almert at dinner at the Carroll Hotel. At 8:30 a public session was held at the Warren Street Theater, at which Mr. Almert delivered an address on "Public Relations."

This address was well received by the people of Vicksburg and a request was made by the Board of Trade for 100 copies.

At 11 p. m. the Sons of Jove commenced their festivities and initiated 14 candidates. The ceremonies were held in the Latticed Dining Room of the National Park Hotel and about 50 Jovians were in attendance.

On Thursday morning the first paper "Mixed and Low-Pressure Turbines," was presented by J. C. Mahoney, of the General Electric Company. Mr. Mahoney explained that the author, H. F. Bussey, was unavoidably detained.

Mixed and Low-Pressure Turbines.

Attention was called to the amount of energy wasted in steam which is discharged at atmospheric pressure and the advantage of a low-pressure turbine over a condensing steam engine. The dimensions of a low-pressure turbine are much less than those of the engine. The low-pressure turbine and condenser will about double the output of a non-condensing engine without increase of boiler capacity, and even a condensing engine will have the economy improved 25 per cent and the peak load increased 60 to 90 per cent by the addition of a turbine. The mixed-pressure turbine is one which may operate under either high or low pressure. It is ordinarily operated at low pressure, but in case of a deficiency of low-pressure steam, or at times when the engine must be shut down, steam is taken directly to the turbine at boiler pressure. This does not complicate the turbine, as the steam is expanded through a set of high-pressure nozzles and impinges upon the same blades which utilize the low pressure. The same control devices and governor operate in both cases. The use of a reducing valve for reducing pressure is not so economical as a separate set of nozzles. An additional advantage of the mixed-pressure turbine is that the machine will carry a certain proportion of its load on high-pressure steam noncondensing. It is not desirable to install units smaller than 300 kilowatts. Where a supply of condensing water is not available, cooling towers or spray systems may often be used. These auxiliaries should be considered before deciding against a low-pressure turbine.

Discussions were engaged in by W. F. Cox, F. L. Bailey, E. J. Lenz, W. F. Gorenflo, H. W. Young, and H. Almert.

The next paper was presented by its author, W. F. Gorenflo, on "Coal, Hand and Mechanically Fired."

The necessity of having a coal suited to the furnace and of properly handling it in the furnace were brought out. Coal should be bought by its heat value, but results obtained in a calorimeter cannot always be duplicated in the furnace, and coal containing less heat units may give better results in a furnace if the furnace construction, method of firing and plant conditions favor it rather than the better coal. Attention was called to the necessary details of the proper handling of a furnace to get the best results. The recognized requirements are a uniform and continuous supply of fuel; an air supply slightly in excess of the theoretical amount required; a temperature sufficiently high to ignite the gases; and a complete mixture of these gases with the air before they reach the boiler shell or tubes. Mechanical stokers usually show better results than hand-firing, because they reduce the cost of handling and the grates are so arranged as to get the best results from their method of feeding. It is hard to get a fireman who will do such regular and consistent work. Constant and intelligent care must be exercised in the boiler room for the best results. Smoke is waste because it indicates that combustibles are going up the stack, but a smokeless furnace does not necessarily mean that conditions are ideal. To burn soft coal without smoke is a simple matter, but to do it with economy requires constant and intelligent attention to the furnace.

This paper was discussed by H. Almert, H. W. Young, W. F. Cox, F. L. Bailey, and W. B. Moorman.

At the executive session, reports of committees were received. That on President's Address and Secretary's Report recommended that committees be appointed to consider the following: Public Utility Commission Laws, Public Policy and Insurance, Line Construction and Grounding Secondaries, Meter Testing and Practice, Electric Heating and Cooking.

The following officers were elected: R. B. Claggett, president; W. F. Gorenflo, vice-president; A. H. Jones, secretary and treasurer.

Members of Executive Committee: F. J. Duffy, A. B. Paterson, S. M. Jones, W. B. Moorman, A. H. Jones.

Invitations for the next convention were received from Hattiesburg, Natchez and Jackson.

At 9 o'clock a banquet was given at National Park Hotel to members and guests, at which one hundred were present.

Electric Vehicles for Sprinkling Streets.

The Municipality of Berlin has found electrically driven machines for cleaning the streets much cheaper than the old horse-carts. There are now twenty-four storage-battery machines and ten horse-carts in use. The working expenses of the former are averaged at $4.40 per day, those of the latter at $4.50, and the electric machines do so much more work that each machine is supposed to save about $1.33 a day by comparison with a horse-driven water-cart. The electric machines are equipped with two electric motors, each of four horsepower, and with a battery of forty cells and a capacity of 200 ampere-hours.

New Electrical and Mechanical Appliances

Cutler-Hammer Portable Meter-Testing Load Rheostats.

The portable meter-testing load rheostat illustrated below weighs only 13 pounds. This is one of a new line of load rheostats placed on the market by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. The rheostats are suitable for both alternating and direct-current service, and the ratings are based on continuous duty on any step. They are adapted for use with meters having the potential circuit across the outer wires and also for those having the potential circuit between the neutral and one outer wire.

The resistance wire is wound on a light fireproof base and is covered with a special cement which prevents shifting and mechanical injury. The switches, mounted on asbestos lumber, are of the single-pole type in which the blade is guided into the clips. The terminal posts are large and placed for easy connection and good clearance. To provide for carrying, the feet can be folded over the frame and latched to form a handle. The line includes rheostats for 115, 230 and 600-volt systems as well as combination 115-230 volt types.

Meter-Testing Rheostat.

Electroplating on Porcelain, Glass and Wood.

An ingenious invention which is illimitable in its applications has been perfected by two Italian chemists, says an English journal. It comprises a means of depositing metals of any character upon any insoluble surface by electrical energy. The results so far achieved promise to revolutionize the whole art of electroplating and decoration. China, wood, glass, celluloid, paper, and other substances which have hitherto been regarded as beyond the electroplater's craft are coated as easily as the metals generally associated with this process. Moreover, the plating is substantially everlasting. It enters into the fabric treated so that it becomes an integral part of the article.

The possibility of being able to plate wooden articles seems so remote as to be fantastic, yet it is as efficiently accomplished by the Marino process as if copper were being plated. So far as china plating is concerned the article must be in the unglazed or biscuit condition, and is first coated with a chemical agent. In the same manner glass which is to be treated must first be roughened by sand-blasting to remove the polish and to enable the metal to secure a grip. The deposit, no matter what the character of the base, may subsequently be oxidized, lacquered, etc., in just the same way as ordinary electroplated work.

The process has extended the electroplater's art to a considerable degree. Any metal and its alloys can be electrically deposited upon some other metal as a base. Zinc, tin, and lead can be deposited as easily as silver or nickel. This fact is of vital interest to a host of industries, as is borne out by the action of one of the largest builders of naval vessels, who has adopted the process for the zinc and tin plating or galvanizing of the steel parts of the boats. The deposit is not so thin, as in ordinary galvanizing, that a pin scratch will penetrate the protective skin, but is a solid sheathing of metal associated with the other metal beneath.

The Cyclone Table Fan.

A new type of electric fan, particularly designed for dining-room or library tables, has been developed and placed on the market by the Fulton-Bell Company, 2 Rector Street, New York City. The motor has a vertical shaft running in a thoroughly lubricated bearing. The mounting is of substantial character, so that the fan is not easily overturned. Directly over the fan blades is a slightly conical deflector which serves to throw the breeze slightly upward and outward in all directions. This has been found to give a very pleasing cooling effect without the chill that some people receive when in the direct blast of a regular fixed or oscillating desk fan, particularly when overheated as is liable to be the case when partaking of a hearty meal in a close dining room. The deflecting plate has a flange to hold a flower pot, fern or other table decoration.

The use of the Cyclone fan insures a steady but not too strong upward current of air all about one's body, thus securing a constant supply of cool, fresh air from the lower part of the room instead of a recurrent draught of heated and vitiated air as when ceiling fans are used. A switch is provided for giving three speeds to the fan.

Cyclone Table Fan.

OIL SWITCHES FOR EASTERN MICHIGAN POWER SYSTEM TESTED AT 465,000 VOLTS.

By D. S. Morgan.

The enormous electric stresses to which apparatus used on extra-high-voltage systems is subjected makes it imperative that such apparatus be most carefully designed and tested before being placed in service to insure against costly breakdowns and interruptions.

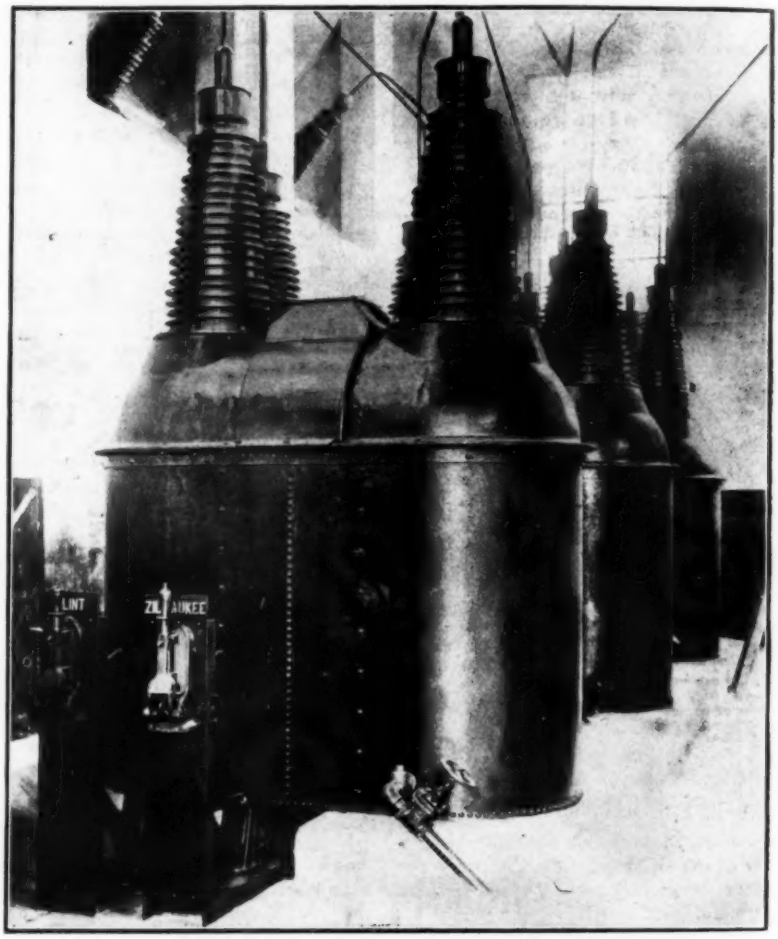
This is particularly true as regards the oil switches depended upon to control and protect the transmission system, since they must not only be able to endure all stresses similar to those borne by the line insulators, transformers, etc., but in addition, those which are added by the necessity of breaking the circuit without undue disturbance under the various abnormal conditions which may arise, that is, they must have an added factor of safety.

These points were taken into full consideration in the design of the switches for the 140,000-volt line of the Eastern Michigan Power Company, the highest voltage line now in commercial operation. The oil switches passed a successful high-potential test of 465,000 volts.

They are, in general, similar to the 110,000-volt General Electric type F, form K-LO, tank-type switches in use in a number of large power plants in this and other countries and are hand operated. However, since it would be impossible to close switches of this size by hand with the ordinary operating mechanism, a newly developed tandem mechanism, in which the operating handle is moved through an angle of 180 degrees, is employed for this purpose. Some of the switches are automatic while others are non-automatic. The automatic switches are opened on overload by a series trip, which acts directly on the locking latch. Each switch consists of three single-pole elements, one in each phase, and in each element there is a double break of sufficient length for more than 140,000 volts.

Since the insulating bushings of high-voltage switches are apt to prove the limiting characteristic, a description of them is doubtless interesting. They consist essentially of an entrance conductor surrounded by a semi-fluid compound contained in an insulating shell. The shell is built up of porcelain end pieces, a series of alternate non-carbonizing rings and treated barriers; the compound contains a number of insulating cylinders concentric with the conductor. The non-carbonizing rings and insulating compound have great dielectric strength. The barriers between rings are of large diameter and resist static surface discharge, thereby increasing the arc-over voltage. The concentric cylinders in the compound distribute potential strains on the interior of the bushing and increase the rupturing strength. The conductor which passes through the bushing serves also as a clamping bolt and holds together the integral parts of the bushing.

About midway between top and bottom of the bushing there is a flanged iron section which supports the bushing when set in the top of the switch tank and bolted to it. This construction enables the bushing to be easily removed for inspection. These switches have been in service for some time and are operating satisfactorily.



140,000-Volt Oil Switches in Zilwaukee Substation.

Bastian Electric Thermal Storage Apparatus.

An apparatus for thermal storage has been invented by C. O. Bastian, the well known British inventor, and was recently patented in Great Britain. As briefly described in *Electrical Engineering*, the Bastian apparatus provides a storage reservoir that is formed of a large number of thin metal sheets bolted together at the corners and kept the requisite distance apart by steatite washers. The heating element is located in the middle of this laminated cube. The whole is inserted in a heat-insulating box with double polished walls. An air inlet and outlet in opposite sides of the box is provided. To use the apparatus, both these are closed, and current supplied until a predetermined high temperature, say 400 degrees centigrade, is reached, when the supply may be automatically interrupted. On opening the valves the air enters cold and emerges hot, and may be caused to circulate in pipes in rooms for warming or in ovens for cooking.

Tungsten for Contact Points.

Developments in the method of producing tungsten in pure metallic form have reached so advanced a stage that this metal is coming into extensive use for contact points in low-voltage apparatus, such as telephone and telegraph instruments, induction coils, etc. For this purpose platinum has been used almost exclusively, but tungsten is much harder than platinum and will greatly outlast that metal in this service.

Substations of the Piedmont System.

The equipment that was recently placed in service by the Piedmont Traction Company, which has commenced the operation of a very extensive electric-railway system in North and South Carolina, is of particular interest because the voltage used, 1,500, is the highest direct-current pressure ever used in this country for electric traction. The property is also of interest because the energy is not generated by the traction company, but is supplied from the Southern Power Company's lines through nine substations to be located respectively at Charlotte, Gastonia, King's Mountain, Spartanburg, Greers, Greenville, Belton, Anderson and Greenwood. A typical substation is shown in Fig. 1. Insofar as possible duplicate equipment is used in all of these stations. The 1,500-volt direct current is obtained by connecting two 750-volt generators in series. All of the equipment is Westinghouse.

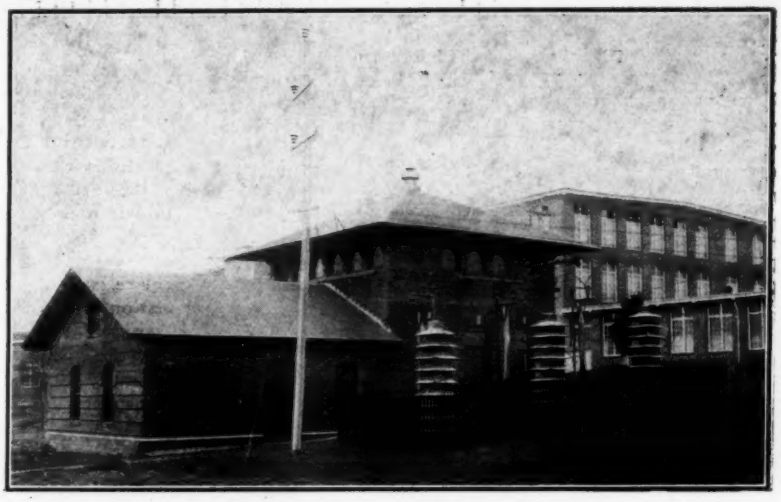


Fig. 1.—Substation of Piedmont Traction Company.

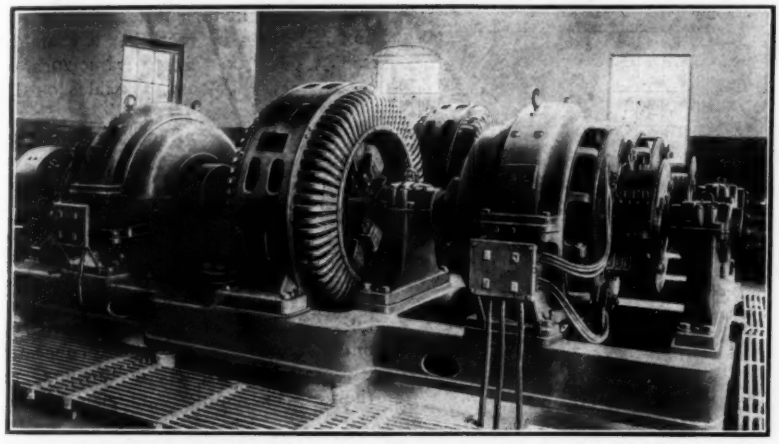


Fig. 2.—Motor-Generator Sets.

All of the motor-generator sets are exact duplicates and each consists of two 250-kilowatt, 750-volt, direct-current, compound-wound generators driven by a 750-horsepower, three-phase, 60-cycle, 2,400-volt synchronous motor. Two of these sets are shown in Fig. 2.

A 6.5-kilowatt, 125-volt exciter for the synchronous-motor field is mounted at the end of the shaft. Two 500-kilowatt direct-current units have been installed in the Charlotte substation, one at Gastonia, two at Dead Falls, two at Greenville, two at Belton, a special one at Anderson and one at Spartanburg.

The energy is taken at the Dead Falls station from a 13,000-volt line and at Belton from a 44,000-volt line which is fed through step-up transformers from a 2,200-volt line at the Greenville substation. In all of the other substations energy is taken directly from the 2,200-volt lines. In all of the substations the switchboard equipment is similar. The view of the switchboard (Fig. 3) is typical of all the substantions. The panels are of black marine-finished marble.

An interesting feature is that the circuit-breakers and knife switches on the 1,500-volt circuits are arranged for remote hand control. Danger of accidents from high-voltage flashes is therefore eliminated. In some of the stations a voltage regulator has been installed for maintaining the alternating-current voltage approximately constant; it does this by acting on the exciter field and thus varying the field excitation of the synchronous motor. Feeders to the trolley circuits are protected by Westinghouse electrolytic lightning arresters. The auto-starter, which reduces the voltage for starting the synchronous motor, is shown back of the switchboard in Fig. 3, which also illustrates the method of supporting the direct-current and alternating-current busbars. The voltage regulator is shown mounted at the left end of the board.

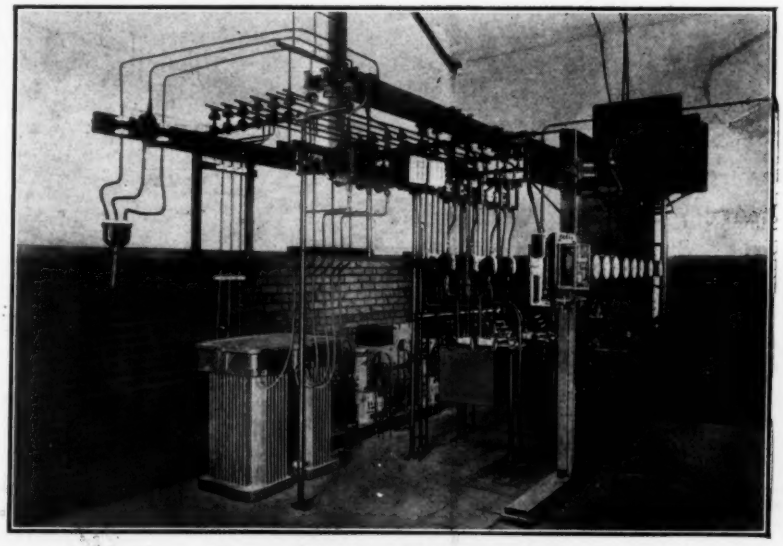


Fig. 3.—Switchboard and Auxiliaries.

Electric Heating and Humidifying.

One of the arguments which has been urged against the adoption of electric heating is that while there is undoubtedly a circulation of air in a room produced by the action of the radiators, this is accompanied by a desiccating or drying action which renders the atmosphere unsuitable for breathing purposes, and may have the effect of producing respiratory complaints, which militates seriously against the health of persons living in rooms heated in this way. Whether this be the case or not is a matter for discussion, but at the same time there is no doubt that a certain amount of humidity in the atmosphere renders it a good deal more pleasant for breathing purposes than one which is too dry.

In order to meet this position, a modified design of electric radiator has been introduced by the British firm of Simplex Conduits, Limited, of Birmingham, England, which presents features of some considerable interest. It should be pointed out that with electric heating the air of the room is not impoverished by the loss of oxygen, or made impure by the formation of gases injurious to health, and if the third requirement, the maintenance of humidity, is obtained, electric heating approaches to the condition of a perfect mode of warming interiors. In the heater under consideration, a small tank containing water is combined with the case of the radiator in such a way that a portion of the heat from the incandescent tubes passes through the tank and is utilized to heat this water up to a moderate degree of evaporation.

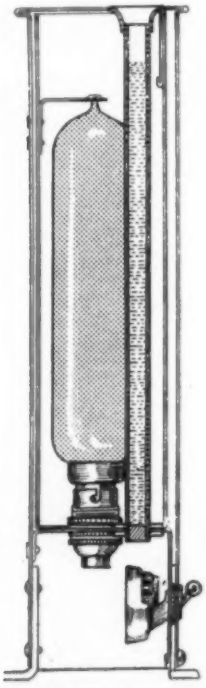


Fig. 1.—Small Electric Radiator and Humidifier.

The heater is constructed in two forms, shown in Figs. 1, and 2, and when so constructed the heater has been found to be suitable not only for domestic purposes but also for offices which, being occupied the whole of the working day, require special attention as to the regulation of the condition of the atmosphere. The slight evaporation of water by the heat produced allows a small quantity of steam to escape into the atmosphere continuously and this produces to a healthful degree the humidity which is required. In the smaller forms where two lamps are adopted the water is placed in tubes at the side of the radiator, while in the larger size, consuming 1,000 watts, the tank is placed at the top. These have been placed in office installations and have been found to give a very great improvement in the quality of the atmosphere.

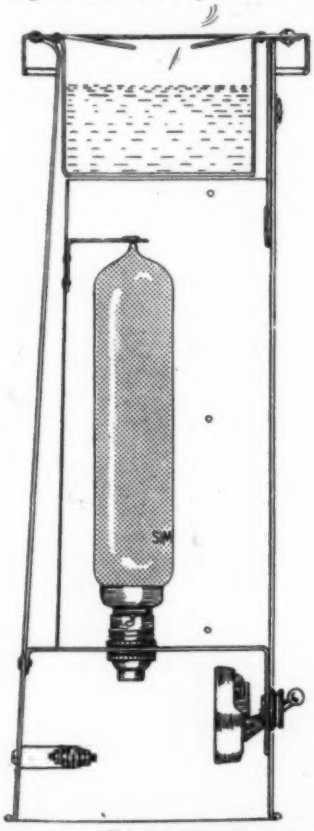


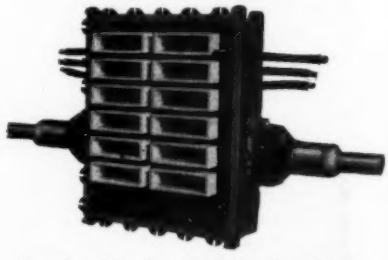
Fig. 2.—Large Electric Radiator and Humidifier.

A New Junction Box for High-Tension Transmission Circuits.

A new type of cable junction box suitable for the interconnection of high-voltage feeders and mains is shown in the accompanying illustration. This is said to be the first high-voltage junction box made in this country. It will be noted that the flexible leads which project through the sides are so arranged as to terminate within the large removable nipple. These nipples have a rounded or dome-shaped end made entirely of soft metal, such as lead or lead-tin alloy. This dome-shaped portion is united with that portion of the nipple which is of brass, or other rigid material, by an exceedingly strong and absolutely watertight joint. The leads are connected to the outermost contact points of each row of disconnecting switches, the innermost point being connected to busbars giving the desired interconnecting arrangements.

The exposed live parts, that is, those shown in the cut, are isolated in cells of porcelain so that the disconnecting blades can be inserted or removed by means of insulated tongs with maximum safety. The porcelain cells are permanently fastened in a metal framework, which in turn is fastened to the box in such a manner that a chamber is formed between the framework of cells and the bottom and sides of the box.

This chamber, after the carrying parts that enter it are put in place and insulated with tape, when desired, and after the moisture has been removed by the heat and vacuum process, is filled with a hot insulating compound. Insulating stuffing boxes prevent the compound from oozing out along the flexible leads when the box again warms up under working load. The concealed current-carrying parts of the box are, therefore, assembled and insulated before the box is sent out from the factory, where the work can be done with the greatest care by operators skilled in that particular class of work and under expert supervision.



Junction Box for High-Tension Lead-Covered Cables.

In order to make the cable connections all that is necessary is to unbolt the nipple from the box, cut off, with a saw or jack klife, the dome-shaped end of the soft-metal portion of the nipple and, after threading it over the cable, join the conductors to the insulated flexible lead. After this the nipple can be replaced, the joint wiped and the space within the nipple filled with hot Ozite insulating compound. The connection is then complete.

As the contact blades, when removed, leave the flexible leads dead, it will be readily seen that in this box one or more of the cables may be connected after the box is in service and while it is alive. This box is adapted for interconnecting two or more one, two, three, or four-conductor cables and may be used for alternating-current or direct-current circuits.

These boxes have been used in considerable quantities on circuits of 4,500 volts working pressure for a period of nearly two years with satisfactory results. In other installations they are operating at 5,000 volts. The same general design is suitable for still higher voltage.

This patented box is manufactured by the Standard Underground Cable Company, of Pittsburgh, Pa. It presents some new and interesting features which make for greater flexibility and convenience in this class of equipment. S. J. Lisberger, of the Pacific Gas & Electric Company, co-operated with the manufacturers in the development of the design of the box.

The Lighting of the Masonic Temple, Jamaica, N. Y.

An effective and artistic scheme of modern lighting has been worked out in the Masonic Temple, Jamaica, N. Y., by Matthew B. Carson, consulting engineer, New York. The temple was formerly a church edifice and has been remodeled to meet the requirements of the fraternity which now uses it as a home.

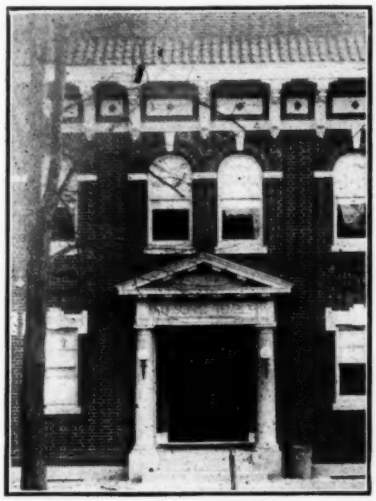
The entrance is colonial in design with flambeaux on the two columns conforming in general design to the colonial effect. The porch is lighted by a ceiling fixture with one outlet, the light being covered by a sand-blasted eight-inch globe, attached by bronze fittings.

The vestibule is lighted by a ceiling fixture with a single outlet, the light being covered by a hemispherical Luceo bowl attached to ceiling rings. The fittings are of brass. The light from this lamp is soft, yet produces a highly efficient illumination. The glare is entirely eliminated and the diffusion is enhanced by means of the luminous globe.

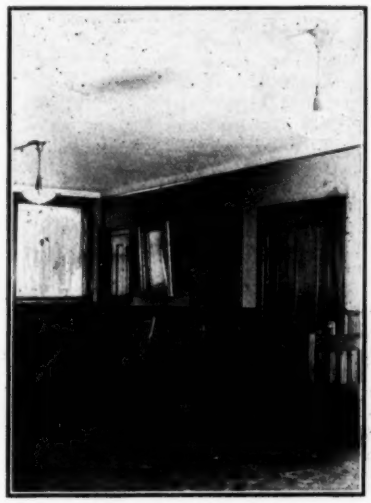
The lobby or general assembly room is 17 by 34 feet, with a 10-foot ceiling. The trim is golden oak and the decorations are in buff and brown tone effects. This room is lighted by two semi-indirect ceiling fixtures, extending 28 inches from the ceiling to the bottom of the glass. The fixtures are of solid brass with gold finish and are of ornate design, with three-point chain suspension from the canopy to the outer edge of the bowl. In each fixture there is a 100-watt Mazda lamp. This is shaded by the translucent bowl, which is of molded "Doric" glass, the production of a prominent lighting studio in New York. The pleasing lighting effect is immediately noticeable upon entering this room. The impression gathered is that of an equally diffused light without sharp shadow. In every part of the room the effect is the same; that is to say, there is no sensation of nearness or farness from the source of light itself. The corners of the room are lighted equally as well as the center or immediately beneath the fixture. This effect has long been sought by illuminating engineers and this room is a fine example of what may be accomplished by the use of properly placed light sources and careful selection of illuminating glassware.

The reception room is paneled in dark oak to six feet from the floor and has a dark oak beamed ceiling, with golden brown decorative tones. This room is lighted by a single fixture similar to that described in the lighting of the lobby. The effect in this instance is also highly satisfactory.

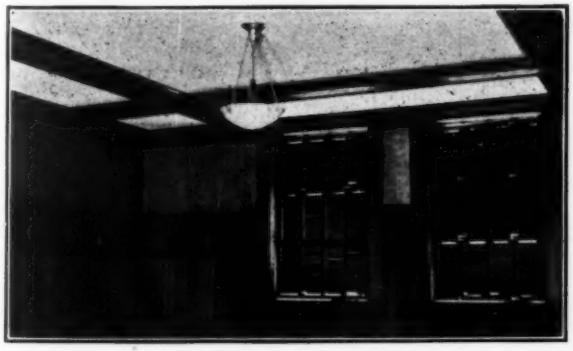
The lodge room was formerly lighted by combination fixtuers on the walls and center of the ceiling. These fixtures were similar to those ordinarily observed in such combinations of lighting, with 16-candlepower carbon lamps set in sockets at an angle of 45 degrees. Because of the expense already incurred no change in these fixtures was permissible at the time, hence the fixtures were again utilized by converting the sockets from the 45-degree angular to a perpendicular position by means of a half-inch connection or adapter.



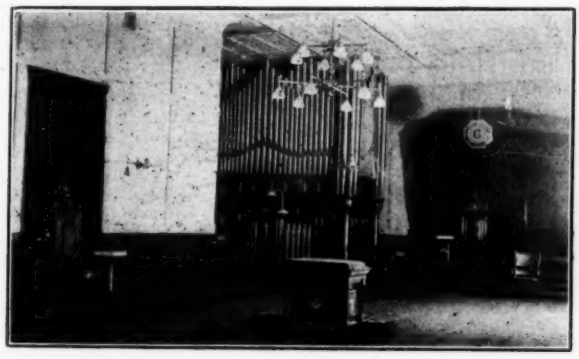
Entrance, Masonic Temple, Jamaica, N. Y.



Lobby and General Assembly Room.



Reception Room.



Lodge Room.

Latest Approved Fittings

ATTACHMENT PLUGS, FUSELESS.—Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Cord connector (composition), Catalog, No. 7650.

Approved May 22, 1912.

ATTACHMENT PLUGS, FUSELESS.—E. H. Freeman Electric Company, Trenton, N. J.

Separable Cap. Catalog No 115, 660 watts, 250 volts.

Approved May 22, 1912.

ATTACHMENT PLUGS, FUSELESS.—General Electric Company, Schenectady, N. Y.

Composition Cap and Porcelain Base. Catalog No. GE105.

Approved May 20, 1912.

CABINETS.—Star Metal Box Company, 201 Fulton Street, New York, N. Y. Pressed steel cabinets without gutters; for switches or cutouts.

Approved May 22, 1912.

CURRENT TAPS.—Bryant Electric Company, Bridgeport, Conn.

"Bryant," 250 watts, 250 volts, Catalog No. 4039.

A combination of a twin, pull, brass-shell socket and a swiveling Edison shell attachment plug. The switch mechanism of the socket controls the circuit to each lamp outlet independently.

Note: Where, in addition to sockets or receptacles already installed, connections are desired on lighting circuits for portable lamps or for motors or other special appliances requiring only small amounts of current, multiple current taps may be used, provided the entire circuit does not require more than 660 watts, and provided their use will not under any conditions involve a departure from the requirements of Rule 23*d* of the National Electrical Code.

Current taps must not be used in key or pull sockets if the device controlled through such sockets requires more than 250 watts.

Approved May 10, 1912.

FIXTURES.—National Chain Company, 517-523 West Forty-fifth Street, New York, N. Y.

A tubular covering of brass wire forming a wire-way for flexible cord and used as a substitute for chain pendants in fixture work or as an ornamental and protecting covering for pendent flexible cords.

The elongation of the tubular covering under stress is such that suitable strain reliefs for the cord connections must be provided by means ordinarily used.

In portable cords or as a substitute for approved armored flexible cord, this covering cannot be recommended, owing to its open construction, lack of tensile strength, ease of elongation under strain and consequent frictional wear on the insulation of the conductors.

Approved May 22, 1912.

GROUND CLAMPS. — Sprague Electric Company, 527-531 West Thirty-fourth Street, New York, N. Y.

"S. E. Co." Galvanized malleable-iron ground clamps provided with hinged joint and screw wedge for securing same to gas pipe and a supporting lug for securing it to outlet box. Catalog Nos. 6102 and 6103.

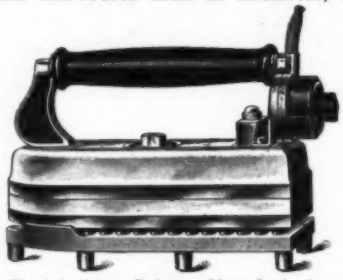
Approved May 13, 1912.

HEATERS, ELECTRIC.—Consolidated Car Heating Company, Albany, N. Y.

Cross-seat car heaters.

Catalog No. 392 with tilting heat deflector.

Catalog No. 392, with three-inch hangers. To be used only when underside of seat is protected by fire-resisting, insulating material not less than one-fourth inch in thickness, or



Electric Iron, Pelouze Manufacturing Company.

by .04-inch sheet metal with one-inch air space over same.

Approved May 15, 1912.

HEATERS, ELECTRIC.—Pelouze Manufacturing Company, 232 East Ohio Street, Chicago, Ill.

Electric Pressing Irons, 100-250 volts.

Domestic Irons, 4, 6.5 and 9-pound sizes; 250 to 650 watts.

Tailor's Irons, 20-pound, size 800 watts, with or without control switch.

Records show that electric pressing irons when left with the current turned on are frequent causes of fire.

In the irons listed above no adequate means have been provided for eliminating this recognized hazard. In other electrical and mechanical details these irons and accompanying stands are judged to be suitably constructed.

Approved May 13, 1912.

LAMP ADAPTERS.—Bryant Electric Company, Bridgeport, Conn.

Large base (Edison) to Standard (Edison); Catalog No. 421.

Approved May 10, 1912.

LAMP ADAPTERS.—General Electric Company Schenectady, N. Y.

Catalog No. GE070, for use with standard Edison base lamps in Mazda lamp outlets, 660 watts, 250 volts.

Approved May 13, 1912.

PANELBOARDS. — Electric Railway & Manufacturers' Supply Company, 84-88 Second Street, San Francisco, Cal.

125-volt, two and three-wire and 250-volt two-wire cartridge, link or Edison plug fuses. All types with or without branch-circuit switches up to 15 amperes.

Approved May 1, 1912.

RECEPTACLES, FOR ATTACHMENT PLUGS.—Machen & Mayer Electrical Manufacturing Company, Seventeenth and Vine Streets, Philadelphia, Pa.

Indicating heater receptacles, consisting of a switch, a receptacle and attachment plug, a bull's eye illuminated by a small brilliant lamp held in a candelabra receptacle, a gang switch box and a brass face plate, 5 amperes, 125 volts, Catalog No. 5105; 10 amperes, 125 volts, Catalog No. 5110; 20 amperes, 125 volts, Catalog No. 5120; 25 amperes, 125 volts, Catalog No. 5125.

Approved May 22, 1912.

RECEPTACLES, STANDARD.—Weber Electric Company, Schenectady, N. Y.

"Two-point Reversible" 1490, 1392 and 1394.

Pull, Catalog Nos. "Universal" 1237, 1239, 1241; "Two-point Reversible" 1389, 1469 and 1489. "Two-point Reversible" 1393, 1395, 1389, 1469 and 1489.

Approved May 22, 1912.

SIGN MACHINES.—Kelley & Kelley, 105 Liberty Street, Brooklyn, N. N.

"Thermo-Blink Tic-Tac" Flashers, 125 volts.

This device is a thermal flasher in which a small vacuum tube containing a small amount of mercury is rocked back and forth by the expansion and contraction of a wire. The circuit is made and broken between the mercury and platinum contacts within the vacuum tube.

Catalog Nos. 606 to 613 inclusive, single tube, single pole, 3 to 12 amperes.

Catalog Nos. 614 to 621 inclusive, double tube, single pole, 15 to 25 amperes.

Catalog Nos. 706 to 709 inclusive, double tube, double pole, 3 to 25 amperes.

Catalog Nos. 710 to 713 inclusive, double tube, double pole, double circuit 3 to 25 amperes.

Catalog Nos. 714 and 716, three tubes, single pole, 25 to 37 amperes.

Catalog Nos. 715 and 717, four tubes, single pole, 38 to 50 amperes.

Catalog Nos. 718 and 719, three tubes three pole, 3 to 12 amperes.

Approved May 22, 1912.

SOCKETS, STANDARD.—Freeman Electric Company, E. H., Trenton, N. J.

Pull, 250 volts, Catalog Nos. 170, 171 and 172.

Approved May 13, 1912.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

FRANKLIN, LA.—This city will extend its electric light system.

GREAT FALLS, ONT.—More lights will be installed in the business section. C.

ASHDOWN, ARK.—This city contemplates constructing an electric light plant.

MT. VERNON, IOWA.—A subscription is being raised for boulevard lights to cost $700. C.

CARTERSVILLE, GA.—This city has voted $50,000 to extend its electric light system.

SCHLESWIG, IOWA.— An electric light plant will be installed at Lakewood Park at Lakeview. C.

NEW SMYRNA, FLA.—John T. Hammond is contemplating the erection of an electric light plant here.

BANNERS ELK, N. C.—Lees-McRae Institute will install hydroelectric plant at an estimated cost of $5,000.

COLEMAN, TEX.—The City Council has taken steps toward installing an electric light and power plant here.

ABERDEEN, S. D.—The Aberdeen Light & Power Company is planning the erection of a new electric light plant.

MORGANTOWN, KY. — Eberman Water-Works Company is contemplating the erection of an electric light plant.

FOWLERTON, TEX. — G. W. Scheuing, McMinnville, Tenn., and associates will construct an electric light plant.

RED WING, MINN.—The present lighting system will be extended and 16 new arc lamps and 5 incandescent lamps will be added. C.

DECHERD, TENN.—The Decherd Mill Company plans the installation of an electric light plant. C. E. Murray is the engineer in charge. G.

LE SUEUR CENTER, MINN.—A franchise for an electric light plant has been granted to James P. Porteus, of Lansing, Mich. C.

MOUNT STERLING, KY.—The Mount Sterling Water, Light & Ice Company is planning to extend its electric light and water system.

HUMBOLDT, IOWA.—It is proposed to build a transmission line to Rolfe and Laurens to furnish these towns with light and power. C.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Power Company has obtained a 30-year franchise to operate in Wyoming Park and Granville.

DOWS, IOWA.—A franchise has been granted to the Segar Engine works for electric lights. The company will invest about $12,000 in the plant and lines. C.

LOUISVILLE, KY.—The Henry Vogt Machine Company is in the market for a generator direct-connected to a Corliss engine. The new units are to produce 300 kilowatts. G.

ALTA, CAL.—The Pacific Gas & Electric Company has started work clearing the right of way for a power line to run from the Alta power house to Lake Spaulding.

MARSHALLTOWN, IOWA.—It was voted to grant a franchise for electric lights, power, gas and street railway to Messrs. Dow, Smith, Reed and Cook, Cedar Rapids, Iowa. C.

PERRY, OKLA.—Arbuckle Canyon Power Company has been incorporated with a capital stock of $10,000 by George A. Masters, R. E. Wade and Charles R. Bostick, all of Perry.

JACKSON, MISS. — The Jackson Light & Traction Company has been incorporated with a capital stock of $1,600,000 by Paul A. Heuffer, Harry H. Phillips and Charles J. Horn.

KEARNEY, NEB.—The Electric Construction Company, St. Paul, received the contract to install a pole line throughout the city, with a lighting plant, the cost to be $21,800. C.

THIENSVILLE, WIS.—Thiensville Electric Light & Power Company has been incorporated with a capital stock of $3,000 by O. R. Liebecher, J. W. Schafer, M. Liebscher and A. Schafer.

SHELBY, N. C.—Ladshaw & Ladshaw, engineers, Spartanburg, S. C., are reported as being interested in a proposition to build a hydro-electric plant at Suttlemyre Shoals, near this city.

HAVANA, CUBA.—Electric light plants are projected for Calabazar Mata and Quemados de Gumes, in Santa Clara Province, to supply public and private demand for electric lighting.

BURKESVILLE, KY.—C. R. Payne will install an electric light plant which will provide current for a street system of 16 lamps and 400 lamps in dwellings. An oil engine will be part of the equipment. G.

BETHANY, MO.—At a recent election here it was voted to issue $25,000 worth of bonds for the purpose of erecting a new municipal light plant and making improvements to the water plant.

MUSCATINE, IOWA.—B. S. Alnutt, chairman of the Boulevard Lighting Committee of the Commercial Club, has outlined the plan which is likely to be adopted for illuminating Second Street.

WHAT CHEER, IOWA.—The stock of the What Cheer Electric Light Company has been sold to a company of which F. A. Heilman is secretary and T. W. Richardson, president. New machinery will be installed and other improvements made. C.

LAS CRUCES, N. M.—An electric power plant will be installed at the state agriculture college here for the purpose of providing power for operating the irrigation pumps upon the farm of the institution. D.

PADUCAH, KY.—The General Council has approved plans for the construction of a "White Way" on Broadway, from First to Sixth Streets. Eight ornamental iron standards, surmounted by four 40-candlepower lamps, will be erected on each block. G.

ALTON, ILL.—The Piasa Light & Power Company has been granted a 30-year franchise to operate in this city, and R. R. Holden, an official of the light company, has announced that a power house at a probable cost of $100,000 will be built and equipped with the latest type of machinery

ST. PAUL, MINN.—The Consumers Power Company has increased its capital $7,500,000, and will remove its headquarters from Stillwater to Minneapolis. Five miles of overhead transmission line will be built to connect with Minneapolis General Electric Company's station and the station of the Consumers Power Company at Taylor Falls. C.

RICHMOND, VA.—A charter has been granted to the Illuminating & Power Securities Company, having a capitalization of $8,000,000, which will act as a holding company for various light and power manufacturing enterprises throughout this state. H. G. Buchanan has been elected president and R. Ripley Dana, of Newton, Mass., secretary.

DUGGER, IND.—The Dugger Electric Light & Power Company has filed articles of incorporation with the Secretary of State. The capital stock is $12,000. The purpose of the corporation is to build, equip, maintain and operate an electric light and power plant at Dugger. The incorporators are W. D. Hudson, W. F. McCaskey and S. F. Seager, all of Lansing, Mich. S.

CONOWINGO, MD.—The Susquehanna Power Company is completing arrangemnets for the construction of a dam across the Susquehanna River as a nucleus for an extensive hydroelectric development and transmission system. It is estimated that the project involves an expenditure of $10,000,000 and that Bertron, Griscom & Jenks, of New York City, are financing it.

BOSTON, MASS.—The Tennessee Eastern Electric Company has been incorporated with a capital stock of $1,650,000 for the purpose of manufacturing and supplying electric light and power. The principal office of the company will be in Boston and the main operations in Johnson City, Tenn. The incorporators are Merrill Griswold, Robert J. Rirchardson and Thomas B. Sweeney.

TUSKOGEE, ALA.—Tuskogee Normal and Industrial Institute will open bids June 24 for a central heating and lighting plant. The machinery will in-

clude boilers, engines, electrical generators, pumps, motors, transformers, etc. Plans and specifications may be obtained at the office of R. R. Taylor, director of industries, Tuskogee, or from Walter G. Franz, consulting engineer, Cincinnati, O.

SAN LUIS POTOSI, MEX.—The Mexico Hydro-Electric Company has prepared preliminary arrangements for the installation of a hydroelectric plant on the Naranjo River, which will have a capacity of 75,000 horsepower. The company will construct electric transmission lines to all of the principal cities and industrial centers in the states of San Luis Potosi, Tamalpais, Nuevo Leon and Vera Cruz.

HOUGHTON, MICH.—Jay P. Graves, vice-president of the Granby Consolidated Mining, Smelting & Power Company, Limited, has announced that work on improvements costing $500,000 will immediately be made on the Hidden Creek property. The directors of the company have agreed to proceed with the construction of docks, railroads to the smelter site and the mines, and a power house.

WACO, TEX.—The Texas Power & Light Company recently completed its organization and filed its charter with the Secretary of State. It has a capital stock of $13,000,000 and its principal office is in Waco. Besides taking over the franchises and other holdings of the electric light, power and gas companies of Waco, Waxahachie, Cleburne, Hillsboro, Sherman, Bonham and Temple the new company has acquired the holdings of the Southern Traction company which is constructing an interurban electric railway between Dallas and Waco. It will make many improvements to the different plants which are embraced in the merger and will also install at Waco an electric power plant at a cost of about $800,000, it is announced.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

GEORGETOWN, MINN.—The Tri-State Telephone Company has been granted a franchise in this town. C.

DEL RIO, TEX.—The Comstock & Langley Telephone Company has been organized here.

CLINT, TEX.—The Clint Telephone Company has adopted plans for the extension of its long-distance system.

PAULLINA, IOWA.—The Northwestern Mutual Telephone Company has been incorporated by H. Hant and others. C.

CARRINGTON, N. D.—The local telephone system will be completely rebuilt and the poles will be placed in the alleys. C.

CASTROVILLE, TEX.—The Medina & San Geronimo Telephone Company has been organized at this place with a capital stock of $6,000.

EAGLE BEND, MINN.—The Eastern Farmers Telephone Company has been organized with a capital of $9,000. W. H. Smith is president and A. B. Rosenquist, secretary. C.

RULEVILLE, MISS.—Burl Telephone Company has been incorporated with a capital stock of $5,000 by J. M. Riddell, J. M. Jones and T. B. Brown.

CLEAR LAKE, IOWA.—The Clear Lake Independent Telephone Company has purchased the Oakwood and Bays telephone line and will build an extension to Dodge's Point. C.

BROADWAY, VA.—Maryland Switchboard Company has been incorporated with a capital stock of $3,000. J. M. Lohris is president and I. N. Zigler, secretary, of the new company.

ARMSTRONG, IOWA.—The Northwestern Mutual Telephone Company has filed articles of incorporation. The capital is $3,000, and J. T. Cheever is named among the incorporators.

CHICAGO, ILL.—Illinois Telephone & Telegraph Company has been incorporated to do a general telephone and telegraph business. The incorporators are S. W. Tracy, J. W. Callahan and M. B. Augur.

ROCK VALLEY, MINN.—Rock Valley Telephone Company has been incorporated with a capital stock of $25,000 by F. W. Chapman, P. O. Kollin, Oscar Gryting, A. O. Anderson and Ole H. Dlaata.

OKLAHOMA CITY, OKLA.—A charter has been issued to the Vanoss Telephone Company of Vanoss, Pontotoc County. The capital stock is $1,000 and the incorporators are A. H. White, J. S. Brook and J. S. Jones, all of Vanoss. P.

WHITE OWL, S. D.—Clarence Dowling, of Wasta, is selling stock in a telephone line that is to connect Marcus, Red Owl and this place, the main line running between Marcus and Red Owl, connecting with a line from Sturgis. C.

TEAGUE, TEX.—The Central Texas Telephone Company has sold its local exchange to the Southweastern Telegraph & Telephone Company. It is announced by the purchasing company that improvements and additions will be made to the property. D.

HUNTSVILLE, TEX.—About $10,000 will be expended on the Huntsville Telephone Company's system, which has recently been sold to the Southwestern. The network of wires will be removed and cables put in the place of them.

POST, TEX.—Garza Telephone Company has been incorporated with a capital stock of $15,000 by Charles W. Post, Arthur D. Williams and M. M. Kinsley, of Battle Creek, Mich.; Samuel B. Bardwell and William O. Stever, of Post.

ELIZABETHTOWN, ILL.—The Elizabethtown Mutual Telephone Company has been incorporated with a capital stock of $2,000 to do a general telephone business. The incorporators are R. H. Willingham, Abram Lawrence, Wiley Lavender.

CHEYENNE, WYO.—A conference was held in this city by representatives of the Mountain States Telephone & Telegraph Company and the Nebraska Telephone Company, at which it was decided to construct additional toll lines to fill the gap between the states of Wyoming and Nebraska.

WAXAHACHIE, TEX.—Ben C. Hyde, of Kansas City, Mo., and associates, who recently entered the independent telephone field of Texas, continue to make investments in local exchanges and it is announced by Mr. Hyde that one of the first improvements to be undertaken will be the construction of a long-distance line between Waxahachie and Dallas, a distance of 30 miles. It is their purpose to construct other long-distance lines and to create a large independent system in this part of Northern Texas. D.

ELECTRIC RAILWAYS.

(Special Correspondence.)

ST. LOUIS, MO.—The East St. Louis Council has granted a franchise to the East St. Louis Electric & Interurban Railway Company to lay tracks on St. Louis Avenue.

HAVANA, CUBA.—General Manager Frank Steinhart, of the Havana Electric Railway Company, has made formal application for a permit to construct two new electric lines within the city.

WASHINGTON, D. C.—The Washington Railway & Electric Company is planning to build a trolley line to connect its present terminus with the plant of the Washington Ordnance Company, at Giesboro.

SCRANTON, PA.—It is rumored that the Scranton & Binghamton Railway Company will build a trolley line to parallel the Lackawanna Railroad from Scranton, through Binghamton and Owego, to Waverly.

NEWTON, KANS.—A company, of which Roy T. Niles, of Canton, is an officer, is planning to build an interurban railroad north from Newton through Canton. It is claimed that Eastern capital is back of the enterprise.

CONCORD, N. H.—The stockholders of the Concord & Montreal Railroad Company have voted to issue new stock to the amount of $1,500,000 to finance the building of an electric railway to the summit of Mount Washington.

COLUMBUS, IND.—The Central Indiana Lighting Company, which controls and operates the local street railway system, is preparing to rebuild the entire system and install a motor generator and other modern machinery. S.

WHEELING, W. VA.—The lines of the Wheeling Traction Company are to be extended as a result of the purchase of a controlling interest by eastern capitalists from local stockholders. B. O. Nagle, general manager, is handling the transaction.

WASHINGTON, D. C.—The Washington, Westminster & Gettysburg Railroad Company, of which William H. Saunders is president, is contemplating the construction of an electric railway from Washington to Sandy Springs and Gettysburg soon.

SACRAMENTO, CAL.—The Sacramento Valley Electric Railroad, incorporated to operate between Red Bluff and Dixon, has applied for permission to issue 300,000 shares of common stock at $100, the money to be used for purchasing rights of way.

GRANVILLE, N. Y.—The Rutland Railway, Light & Power Company has added $1,000,000 to its capital stock, which will be used to build an extension of the street railway line from Poultney to Granville, and to further extend all high power-transmission lines of the company.

LaPORTE, IND.—The directors of the Chicago-New York Air Line are planning to run cars into Gary, July 1, and immediately thereafter to commence the building of the first division east of LaPorte, which will run to South Bend, Elkhart and Goshen, the terminus of the division. S.

ALBION, MICH.—The Albion, Brookfield & Charlotte Railroad will be constructed this summer by a new company, which has purchased the title to the bonds issued some years ago in the amount of $250,000. L. C. Davis, of Chicago, is president, and A. E. Ellerthrope, Jackson,

Mich., vice-president of the new company. It is expected to have the road in operation by November 1.

WELLS, MINN.—Basil Smouth has been elected chairman of a committee to raise funds for the proposed electric line through here, for which surveys were made last fall. The line will be run from Wells to Waldorf and Faribault. C.

FORT WORTH, TEX.—The Baptist Seminary Street Railway Company, which was recently organized with a capital stock of $26,000, will construct an interurban electric line from Fort Worth to suburban points. The incorporators are L. R. Scarbrough, J. K. Winston and H. C. McCart. D.

ROCKLAND, IDAHO.—J. P. Rudd, vice-president of the Portneuf Development Company, has made the announcement that a corps of engineers will immediately be placed at work on a survey for the electric railroad from American Falls into the Rockland Valley. This line will be 40 miles in length.

BEAUMONT, TEX.—It is announced by M. M. Phinney, of Dallas, representative of the Stone & Webster Engineering Corporation of Boston, Mass., that that company will soon begin the construction of an interurban electric railway between Beaumont and Port Arthur, a distance of 25 miles.

GRETNA, LA.—A 99-year franchise has been granted to Leo. A. Marrero to build an electric line from Gretna to Waggaman. It is announced that the work of building the line will be rushed after the sale of the franchise by Mr. Marrero, and although no definite statement has been given to the public, it is understood that the Canadian syndicate, which now controls the other roads over the River, will in all probability be the company to build the road.

SAN ANTONIO, TEX.—F. S. Pearson, of New York, and associates who compose the Medina Valley Irrigation Company that is constructing dams across the Medina river and a system of irrigation near here at a total cost of about $8,000,000, have under consideration the proposition of constructing an interurban electric line between San Antonio and the site of the main dam through the 60,000-acre tract that is to be irrigated, and upon which four new towns are being established. D.

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following items should address the Bureau of Manufactures, Washington, D. C., and refer to the file number noted.)

NO. 8920. ELECTRIC CAR LINES.—An American consul in a Latin American country has forwarded a report on a proposed concession for new electric car lines in his district.

NO. 8927. ELECTRIC TRANSPORTERS.—The American consul at Montevideo, Uruguay, reports that tenders have been called for furnishing and erecting 24 electric transporters, to be used at the port of Montevideo. Bids will be received until July 13. Plans and specifications may be seen at the office of the Minister of Public Works; the cost of the plans is $5.17.

NO. 8959. ELECTRIC POWER HOUSES AND MILLING PLANTS.—Owing to the growing scarcity of fuel in a certain foreign country many mining companies are considering the advisability of establishing electric power plants. The initial move has been made by a prominent local firm which contemplates the establishment of a large power-house for supplying power to several mines.

PROPOSALS.

CONDUIT AND FITTINGS.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until July 9, for steel and brass conduit and fittings, as per Schedule 4646.

INSULATOR HANGERS.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., unil July 9, for insulator hangers, as per Schedule 4646, to be delivered at the Brooklyn Navy Yard.

INSULATORS, PORCELAIN, CLAMP.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until July 9, for porcelain, clamp insulators, as per Schedule 4646, to be delivered at the Brooklyn Navy Yard.

ELECTRIC PUSH-BUTTON LIFT.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until July 5, for an electric push-button lift in the post office at York, Pa., in accordance with specifications, copy of which may be obtained from the Supervising Architect.

MOTORS AND SWITCHES.—Sealed proposals will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until June 21, for furnishing and delivering at f. o. b. cars shipping point three 85-horsepower, 2,200-volt induction motors, one 50-horsepower, 2,200-volt induction motor, and four 4,500-volt, 100-ampere oil switches.

ELECTRIC CONDUITS, WIRING SYSTEM AND LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until July 16, for electric conduits, wiring system and lighting fixtures for the United States appraisers' stores, Galveston, Tex. Drawings and specifications may be obtained from the custodian of the site at Galveston or from the office of the Supervising Architect.

ELECTRIC CONDUITS AND WIRING, AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until July 15, for electric conduits and wiring, and interior lighting fixtures of a one-story and basement building for the post office at Fairmont, W. Va. Drawings and specifications may be obtained from the custodian of the site or from the office of the supervising Architect.

AUXILIARY ELECTRICAL EQUIPMENT FOR GATUN HYDROELECTRIC STATION.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until July 8, for furnishing auxiliary electrical equipment for Gatun Hydroelectric station, consisting of switchboards, switching group, transformers, battery, air compressor and crane equipment, as per Circular 715. Blanks and general information thereto may be obtained from the office of the General Purchasing Officer or from the offie of Assistant Purchasing Agents, located in the principal cities of the United States.

FINANCIAL NOTES.

At a meeting of committee of the bondholders of the Toledo Railway & Light Company, provision was made for the appointment of a sub-committee of three, to meet with a similar sub-committee from the stockholders' committee, to discuss plans of reorganization of the company. These sub-committees are to report back to a joint meeting of the committees of bondholders and stockholders to be held on or before June 26. If the sub-committees fail to agree upon a reorganization plan satisfactory to both committees then bondholders will at once proceed to take steps to reorganize the company on a plan of their own. The bondholders' committee also provided for payment of interest due July 1 on bonds of underlying companies, and recommended that present special rates of practically three-cent fares on street-railway lines be kept in effect until they have been in operation for six months, which will be about August 1.

The stockholders of the Puget Sound Light & Power Company will hold a special meeting June 27 to vote on giving the directors the power and authority to sell the property and assets of the company to a new corporation to be incorporated under Massachusetts laws.

Consolidation papers have been filed at Dover, Del., between the Wilmington, New Castle & Southern Traction Company and the New Castle & Delaware City Traction Company for the purpose of operating a line between Wilmington, New Castle and Delaware City. The new company is chartered at $250,000.

At a special meeting of the stockholders of the Susquehanna Railway, Light & Power Company the proposition to merge the company with the United Gas & Electric Corporation was unanimously ratified. The new company has an authorized capital stock of $25,000,000 6-7 per cent cumulative preferred, $20,000,000 common stock and $7,500,000 3-year 5-per-cent convertible secured notes, making a total of $52,500,000. The company has secured control of a large number of gas and electric light and power companies throughout the country.

The Southwestern Telephone & Telegraph Company has purchased the telephone system of the Lawrence County Telephone Company, a local and independent concern that has been in operation for the past fifteen years.

General Manager B. O. Nagle, of the Wheeling Traction Company, acting for unnamed Eastern capitalists, has purchased the controlling interest in the company's lines for $2,796,000, the stock being taken in at 120, 16 points above its present market quotation.

Negotiations looking to the purchase of a majority of the stock of the Kentucky Electric Company, of Louisville, Ky., by H. M. Byllesby & Company, and others, who have recently acquired control of the Louisville Gas Company, the Louisville Lighting Company, the George G. Fetter Lighting & Heating Company, and a minor plant, were upset last week by the filing of a petition for an injunction by the city of Louisville. The suit was filed by City Attorney Clayton Blakey under instructions from Mayor W. O. Head, and asks that the court enjoin the defendants from selling out or bargaining to sell out. Those named as defendants, besides the Kentucky Electric Company and its officers and directors, are H. M. Byllesby & Company, the the Louisville Lighting Company and the Louisville Gas Company. The petition not only appeals for the prohibition of

the sale of the stock of the Kentucky Electric Company to H. M. Byllesby & Co., but also for an order enjoining the Kentucky Electric Company from selling or transferring any of its property or its franchise for the benefit of the Louisville Lighting Company. The petition is based on the franchise of the Kentucky Electric Company, in which the purchaser of the franchise is prohibited from selling out to a competing company.

Mayor Head, who prevented a merger of the various companies from taking place some time ago by opposing an ordinance which would have enabled this to be done, declared in an interview following the filing of a petition that he ordered the injunction suit filed in order to protect consumers.

The ordinance creating the franchise specifically forbade the Louisville Lighting Company, which at that time was the only central station in the field, from bidding for it. It was purchased by interests which shortly afterwards formed the Kentucky Electric Company, for a little over $100,000, the company having been in existence since 1906, although it was not ready for operation until 1908. It has a franchise which enables it to operate any where in the city, but it was not required to operate anywhere except in the central district.

The Kentucky Electric Company has $3,000,000 capital stock, which was issued in exchange for $600,000 of stock, the company being originally capitalized at that figure. When the new issue was provided for the old stock was taken in at the rate of five shares for one. The new transfer of stock was to have been made, it is stated, on a basis of $76 a share, which would have given the stockholders $2,280,000, or a profit on their holdings of $1,680,000. It is said that this feature of the transaction is what caused the mayor of Louisville to frown on the deal, as he insisted that the consumers of Louisville would be compelled to pay it back to the purchasers.

The property of the Fremont Light & Power Company was sold at sheriff's sale on June 7, to W. H. Schutt, of Chicago, for $27,000. The property was sold to satisfy the claim of M. W. King against the concern.

P. W. Brooks & Company, New York City, announce that the issue of $700,000 Jackson Light & Traction Company first 5's of Jackson, Miss., has been oversubscribed.

Interborough Rapid Transit gross, in May, gained $3,900 per day, or $121,000 for the month. It is slightly above average gain for previous ten months of $116,500.

The American Gas & Electric Company has issued a circular to stockholders, notifying them that subscriptions will now be received to $500,000 of the $1,000,000 of common stock in the treasury of the company at par, or $50 a share.

The Burlington (Iowa) Railway & Light Company has sold to a syndicate composed of W. C. Langley & Company, William Morris Imbrie & Company, New York, and others, $1,400,000 five-per-cent first-mortgage 20-year bonds, out of an authorized issue of $8,000,000. Bonds will be offered on a basis to net about 5.30 per cent.

A representative of the Brooklyn Rapid Transit Company says that earnings are running at the rate of about eight per cent on the stock. He adds that the number of shareholders has shown a a large increase over the past year and that judging from the present indications there is every reason to believe that this increase will be continued.

Allotments have been made by J. P. Morgan & Company in the $170,000,000 Interborough Rapid Transit bond syndicate. The larger subscribers will receive somewhat less than the amount for which they applied, while applicants for smaller participations will be given the full amount. There are several hundred participants in the syndicate.

Assistant Treasurer Milne, of the American Telephone & Telegraph Company informs holders of temporary receipts of American Telephone & Telegraph Company for bonds or shares of Cumberland Telephone & Telegraph Company that the 20-year first and general-mortgage five-per-cent bonds of the Cumberland Company are ready for delivery at his office in New York upon surrender of the temporary receipts. Such receipts should be assigned either to American Telephone Company or in bank. If otherwise assigned they should be presented by the assignee or accompanied by his order for delivery of the bonds. Bearers of receipts and orders when not known must be identified. The denomination desired, whether $1,000 or $500, should be indicated.

Dividends.

Chicago City Railway Company; quarterly dividend of 2.5 per cent, payable June 28, to stock of record June 18.

Commonwealth Power, Railway & Light Company; a quarterly dividend of 1.5 per cent, payable Aug. 1, to stock of record July 19.

Consumers Power Company; a quarterly preferred dividend of 1.5 per cent, payable July 1 to stock of record June 17.

Cleveland Railway Company; a quarterly dividend of 1.5 per cent, payable July 1 to stock of record June 15.

Illinois Traction Company; a quarterly dividend of 1.5 per cent, payable July 1.

Indianapolis Street Railway Company; a semiannual dividend of three per cent, payable July 1 to stock of record June 21.

Interborough Rapid Transit Company; a quarterly dividend of 2.5 per cent, payable July 1 to stock of record June 22.

Lake Shore Electric Company; a quarterly first-preferred dividend of 1.5 per cent, payable July 1 to stock of record June 20.

Manhattan Railway: the regular quarterly dividend of 1.75 per cent, payable July 1 to stock of record June 15.

Mohawk Valley Company regular quarterly dividend of 1.5 per cent, payable July 1 to stock of record June 24.

New York State Railways; a quarterly common dividend of 1.5 per cent, and a preferred dividend of 1.25 per cent, both payable July 1 to stock of record June 17.

Niagara Falls Power Company; a quarterly dividend of $2 per share, payable July 15 to stock of record June 15.

Public Service Corporation of New Jersey; the regular quarterly dividend of 1.5 per cent, payable June 29 to stock of record June 28.

St. Joseph Railway, Light, Heat & Power Company; a quarterly preferred dividend of 1.25 per cent, payable July 1 to stock of record June 15.

Toronto Railway Company; a quarterly dividend of two per cent, payable July 2 to stock of record June 15.

Union Railway Gas & Electric Company, a quarterly preferred dividend of 1.5 per cent, payable July 1 to stock of record June 17.

Union Traction Company, of Philadelphia; a semiannual dividend of three per cent, payable July 1 to stock of record June 8.

United Traction & Electric Company; a quarterly dividend of 1.25 per cent, payable July 1 to stock of record June 11.

Utica & Mohawk Valley Railway; the regular quarterly dividends of one per cent on the common stock and 1.25 per cent on the preferred stock, payable June 29, to stock of record June 22.

West Penn Traction & Waterpower Company; an initial dividend of 1.5 per cent on the preferred stock, payable June 15 to stock of record June 11.

Reports of Earnings.

EDISON ELECTRIC OF BROOKLYN.

The New York Public Service Commission has issued a report covering the operations of the Edison Electric Illuminating Company of Brooklyn, for the year ended December 31, 1911, which compares as follows:

	1911	1910
Operating revenue...	$ 4,707,915	$ 4,249,941
Operating expense and taxes	2,928,450	2,573,128
Operating income..	1,779,465	1,676,813
Other income.....	24,613	21,416
Total income.....	1,804,078	1,698,229
Charges	1,763,516	1,659,984
Net corporate income	40,562	38,246
P. & L. adj., debit..	40,562	38,246

LAKE SHORE ELECTRIC.

The Lake Shore Electric Railway reports April and the four months ended April 30 as follows:

	1912	1911
April gross.....	$ 97,806	$ 91,958
Net after taxes.....	37,917	38,751
Surplus after charges....	3,064	4,137
Four months gross.....	359,197	339,314
Net after taxes.....	128,513	138,796
Deficit after charges.....	10,534	18

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	June 10.	June 3.
Allis-Chalmers common (New York)	¾	¾
Allis-Chalmers preferred (New York)	2	2
American Tel. & Tel. (New York)	145⅝	145½
Commonwealth Edison (Chicago)	139	138
Edison Electric Illuminating (Boston)	285	*282
Electric Company of America (Philadelphia)	*12¼	12¼
Electric Storage Battery common (Philadelphia)	56	55½
Electric Storage Battery preferred (Philadelphia)	56	55½
General Electric (New York)	169	167
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	2½	2⅛
Massachusetts Electric common (Boston)	20	20
Massachusetts Electric preferred (Boston)	92	93
National Carbon common (Chicago)	118	118
National Carbon preferred (Chicago)	118	118
New England Telephone (Boston)	*152	*152
Philadelphia Electric (Philadelphia)	21⅞	21½
Postal Telegraph and Cables common (New York)	85	83½
Postal Telegraph and Cables preferred (New York)	68¾	69
Western Union (New York)	83	81⅝
Westinghouse common (New York)	72½	71½
Westinghouse preferred (New York)	117	116

*Last price quoted.

INTERBOROUGH RAPID TRANSIT.

The earnings of the Interborough Rapid Transit Company for the month of April and ten months ended April 30, 1912, compare as follows:

	1912	1911
Gross	$ 2,806,389	$ 2,658,586
Net	1,713,755	1,583,408
Taxes	167,359	167,047
Income from operation	1,546,396	1,420,362
Other income	30,147	26,047
Total income	1,576,542	1,446,408
Surplus after charges	657,717	558,377
Passengers carried	54,664,792	51,774,277
July 1 to April 30:		
Gross	$25,986,784	$24,781,481
Net	15,119,958	14,543,486
Taxes	1,629,958	1,560,253
Operating income	13,490,000	12,983,233
Other income	313,425	277,707
Total income	13,803,425	13,260,939
Surplus after charges	4,636,143	4,386,611
Passengers carried	505,115,159	481,191,629

PERSONAL MENTION.

JACK ABBOTT, of Jackson, Miss., has been appointed superintendent of the Lafavette Street Railway to succeed R. W. Levering, resigned.

CYRIL NAST, advertising manager of the New York Edison Company, has been elected treasurer of the Technical Publicity Association.

GEORGE H. LYNE, Henderson, Ky., has resigned his position as superintendent of the Henderson Traction Company to further his studies of electrical engineering.

F. R. DAVIS, of the General Electric Company, has been made first vice-president of the Technical Publicity Association. Mr. Davis was formerly secretary.

W. C. DE VANE, superintendent of the Savannah (Ga.) Electric Company, has severed his connection with that company with the intention of going in business for himself.

F. J. LOW, advertising manager of the H. W. Johns-Manville Company, has been made a member of the Executive Committee of the Technical Publicity Association.

E. DUDDELL, whose work in developing the oscillograph and other scientific investigations is well known, has been elected president of the Institution of Electrical Engineers of Great Britain.

E. H. SHUFRO has resigned as purchasing agent of the Union Electric Light & Power Company, St. Louis, Mo., to engage in other interests. Mr. Shufro expects to make his home in New York City hereafter.

W. P. HEMPHILL, who has been general manager of the Topeka Independent Telephone Company for the last nine years, has been elected vice-president and general manager of the Southwestern Blaugas Company, Kansas City.

HOWARD LANCASTER, city electrician of Paris, Kv., has resigned to become chief of the telephone dispatching service, which is being installed by the Lexington & Eastern. Mr. Lancaster's headquarters will be at Lexington, Ky.

SCHUYLER SKAATS WHEELER has recently had the honorary degree of Master of Science conferred upon him by Columbia University, of which he is a graduate. Dr. Wheeler is a past-president of the American Institute of Electrical Engineers.

WILLIAM B. SNOW, Holyoke, Mass., will soon become associated with the New Bedford Gas & Edison Light Company, with headquarters at New Bedford, Mass. Mr. Snow has been engaged in the lighting industry in Holyoke for the past 37 years, 28 of which were spent with the Holyoke Water Power Company, the other nine being spent with the municipal plant.

JOHN I. MANGE, who for the last six years has been manager of the Watertown (N. Y.) Light & Power Company, has severed his connection with that concern to become general manager of the Associated Gas & Electric Company, with headquarters at Ithaca.

JOHN FALLON, formerly of the Tennessee Copper Company, has taken charge of the firm of Ashley & Kaufman, consulting engineers. This office is located at 14 International Amphitheater, Union Stock Yards. The firm has been retained as consulting engineers for the heating, lighting and sanitation of the stock yards.

J. G. HENNINGER and C. R. STOVER, illuminating engineers connected with the Engineering Department of the National Electric Lamp Association, Cleveland, O., have been spending a couple of weeks with the Contract Department of the Birmingham Railway, Light & Power Company, Birmingham, Ala., in the interests of better lighting in stores, business houses and residences. The trip was made possible by the cooperation of the Buckeye Works.

WILLIAM A. SCOTT has accepted a position with the Boston office of the Crocker-Wheeler Company, and will be located as resident manager in Springfield, Mass., with headquarters at 318 Main Street, after July 1. Mr. Scott entered the testing department of the General Electric Company in 1899. He later accepted a position with the Ward Leonard Electric Company, and was subsequently for five years in the testing and sales departments of the Stanley Electric & Manufacturing Company. In 1906 he entered the employ of the Boston Edison Company, and for the past six years he has been associated with the Boston office of the Westinghouse Electric & Manufacturing Company.

OBITUARY.

SETH CLINTON CATLIN, the inventor of an electroplating machine and carboy rocker, died at his home in Bloomfield, N. J., recently. Mr. Catlin was more than 70 years of age and had been until a year or two ago actively associated with the electroplating industry for 40 years.

ROBERT FRANCIS CARTWRIGHT, at one time a Public Service Commissioner and a prominent builder of elevators, recently died at his home in New York City, at the age of 65. Mr. Cartwright was for many years engaged in business in the firm of McAdams-Cartwright Company, elevator builders, and for the past five years was connected with the Otis Elevator Company.

NEW PUBLICATIONS.

STUDIES IN MAGNETIZATION.—We are in receipt of contributions from the Jefferson Physical Laboratory of Harvard University by B. O. Peirce entitled "Anomalous Magnetization of Iron and Steel," and "The Effects of Sudden Changes in the Inductances of Electric Circuits upon Finely Divided Cores."

CANADIAN COAL.—Vol. II of the reports upon an investigation of the coals of Canada with reference to their economic qualities which is being prepared by the Department of Mines, Ottawa, has appeared. It is concerned with tests made with boilers and with gas producers and with the work of the chemical laboratory.

THE DIESEL ENGINE.—A lecture delivered by Rudolf Diesel before the Associated Engineering Societies of St. Louis, Mo., Cornell University, United States Naval Academy and the American Society of Mechanical Engineers, entitled "The Present Status of the Diesel Engine in Europe and a Few Reminiscences of the Pioneer Work in America," has been issued in pamphlet form and is being distributed by the Busch-Sulzer Brothers-Diesel Engine Company, St. Louis, Mo.

THE INFLUENCE OF ILLUMINATION CONDITIONS UPON EYE STRAIN.—The Holophane Company has published in very handsome brochure from the thesis entitled "The Influence of Illumination Conditions Upon Eye Strain." This paper was presented in full in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for March 16, 1912, and the topic was also the subject of an address delivered before the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers.

TESTS OF CROSS ARMS.—The Forest Service, Washington, D. C., has issued Circular 204 entitled "Strength Tests of Cross-Arms," by Thomas R. C. Wilson. This circular gives the methods and results of tests made upon cross-arms of Douglas fir, short-leaf pine, long-leaf pine and Southern white cedar. The long-leaf pine showed the greatest average strength and the cedar the least. In the ordinary size, 3.25 by 4.25 inches and 6 feet long, the latter are quite strong enough, nevertheless, to carry any load which may be placed upon them in ordinary service. With longer arms the strength is much more important. The abilty of the timber to resist decay is of greater importance than its strength.

NEW INCORPORATIONS.

MILWAUKEE, WIS.—Northern Electric Company has been incorporated with a capital stock of $5,000 by William G. Scheneck, Thomas J. Perry and August E. Mauthey.

NEW YORK, N. Y.—Bronx Electrical Supply Company has been incorporated with a capital stock of $2,000. The incorporators are Louis Vinograd, Abraham Breitbard and Theodore Siegel, all of New York City.

CHICAGO, ILL.—The Keene-Judd Company has been incorporated with a capital stock of $2,500 to manufacture and deal in electrical machinery. The incorporators are Charles O. Hendricks, Carl O. Beroth, A. W. Westergreen.

JAMAICA, N. Y.—Long Island Machine Tool & Electrical Works, Incorporated, has been incorporated with a capital stock of $10,000 by Charles Wachtel, William D. Llewellyn, Jamaica; and George J. Distler, Woodhaven, L. I.

TOLEDO, O.—The J. J. Duck Company has been incorporated with a capital stock of $50,000 to do an electrical construction and supply business. The incorporators are John J. Duck, William B. Duck, C. A. McNeil, H. M. Hart and F. E. Leonard.

NEW YORK, N. Y.—King Burglar Alarm Company has been incorporated with a capital stock of $60,000 to install electrical alarm devices. The incorporators are Fred T. King, Brooklyn, N. Y.; Fred B. Holden and Alfred Houston, of New York City.

DATES AHEAD.

National Railway Electrical Engineers' Association. Atlantic City, June 12-19.

Minnesota Electrical Contractors' Association. Annual convention, Duluth, Minn., June 17.

Canadian Electrical Association. Annual convention, Ottawa, Ont., June 19-21.

Michigan Section of the National Electric Light Association. Annual convention on board the *Majestic*, sailing from Port Huron, Mich., on June 21 and returning June 25.

National District Heating Association. Annual convention, Detroit, Mich., June 25-27.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25-28.

Society for the Promotion of Engineering Education. Annual meeting, Boston, Mass., June 26-29.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., July 16-19.

Ohio Electric Light Association. Annual convention, The Breakers, Cedar Point, O., July 16-19.

International Association of Municipal Electricians. Annual convention, Peoria, Ill., August 26-30.

International Association for Testing Materials. Sixth congress, New York City, September 3-7.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Pfister, Milwaukee, Wis., September 16-21.

The 1912 Boston Electric Show, Mechanics Building, Boston, Mass., September 28-October 26.

American Electric Railway Association and its five affiliated associations. Annual convention, Chicago, Ill,. October 7-11.

New England Section of the National Electric Light Association. Fall meeting, Boston, Mass., October 10-11.

The New York Electrical Exposition. The New Grand Central Palace, New York City, October 9-19.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

With the Electrical Manufacturers

The Monarch Incandescent Lamp Works of General Electric Company has moved its offices from 900 Wabash Avenue to 1109 Manhattan Building, Chicago, Ill.

Kinetic Engineering Company, Philadelphia, Pa., is sending out to contractors some folders in which an attractive proposition is made to them for the installation of Kinetic electrically driven organ blowers.

C. S. Knowles, 7 Arch Street, Boston, Mass., has opened a new Chicago office at 631 West Jackson Boulevard. This office will be in charge of Frederick D. Sweet, late general manager of the Guarantee Electric Company of Chicago.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued circular 1194, devoted to type Q direct-current engine-driven generators. The parts of these machines are illustrated and described and there are also a number of illustrations showing typical installations of these generators.

The Canadian H. W. Johns-Manville Company, Limited, has moved its Winnipeg branch into its new six-story building, 50 by 100 feet, located at 92 Arthur Street. This permits the company to carry a larger and more complete stock of its asbestos, magnesia and electrical supplies. A larger selling force will be employed to look after the company's interests.

Western Electric Company has moved its Texas headquarters from Dallas to Houston, which will become a new distributing center for the Southwest. Harry P. Hess has been appointed manager of the Houston office. This change makes it possible to carry a larger stock of goods on hand and to make more ready shipments.

Flexlume Sign Company, Buffalo, N. Y., is sending out a circular calling attention forcibly to the merits of its Flexlume electric sign. In these signs each letter is made of raised prismatic glass complete in one piece. These letters stand out from the background very effectively. As a rule only one 25 or 40-watt tungsten lamp need be used for each letter.

The Koerting & Mathiesen Company, 22 East Thirty-first Street, New York, N. Y., has moved its Chicago offices to 631 West Adams Street. This company, which is the American distributor for the manufacturers of Excello flaming arc lamps, has just published a general price list on Excello flaming arc lamps and supplies. This will be furnished to those interested upon request.

The General Vehicle Company, Long Island City, N. Y., states that it has made and sold over one-quarter of the entire commercial motor-truck equipment used in New York City. Over 1,000 trucks have been placed in service by the company in that city alone. Among recent sales have been very heavy shipments to the Adams Express Company, American Express Company, White's Express Company, etc.

Wagner Electric Manufacturing Company, St. Louis, Mo., has issued Bulletin 96 devoted to the instruments of precision which it manufactures. This is a 48-page bulletin, well illustrated with views of various types of voltmeters, ammeters and other instruments and their parts. The construction of the instruments is fully described. Typical scale diagrams and dimension drawings are shown and a full list of sizes and prices included.

The Electric Storage Battery Company, Philadelphia, Pa., has issued Bulletin 136 entitled "Storage Battery Railway Cars." This is a 16-page bulletin, well illustrated, that shows the value of storage-battery traction for street-railway and railroad-feeder lines where an overhead or conduit trolley system is either not permitted or not justified on account of its heavy expense. The advantages of storage-battery equipment for such service are carefully pointed out. A number of typical cars are described in which Hycap-Exide batteries are used. Several installations are also described and a brief summary is given of the results obtained from this method of operation.

The Goulds Manufacturing Company, Seneca Falls, N. Y., has issued a folder which is being sent to architects, engineers, central-station interests and contractors, and calls attention to its twelve bulletins relating to pumping equipment manufactured by the company. Of these bulletins, No. 112 gives handy general data on power pumping; other bulletins are devoted to double-acting piston pumps, triplex plunger pumps, single-acting triplex plunger pumps, horizontal and vertical, double-acting triplex piston pumps, single-stage single-suction centrifugal pumps, vacuum and stuff pumps, deep-well triplex pumps and single-stage double-suction centrifugal pumps. There are also other bulletins on pumps for special services. All these bulletins give specifications that will be of value to architects and engineers.

The Sprague Electric Works of General Electric Company, New York, N. Y., has been awarded the contract for furnishing and installing a complete electrical equipment in the new plant of the New York *Tribune*. The apparatus will consist of one 200-kilowatt, 125-volt, engine-type generator, two 60-horsepower, double motor equipments with full automatic push-button control systems for operating Duplex newspaper presses, two electric hoists for handling paper rolls, various individual motors for operating stereotyping machinery. The present switchboard is to be remodelled with new instruments, switches, etc. Sprague conduit will be used in the installation. Thirty-two linotype machines in the composing department are already driven by Sprague Electric motors and with the new additions to be made the plant will be a modern one in every respect. The Sprague Electric Works has long made a specialty of this class of installation and the *Tribune* outfit will be a striking example of what electricity is doing for the modern newspaper.

Record of Electrical Patents.

Issued by the United States Patent Office, June 4, 1912.

1,028,104. Strain Insulator. O. L. Fletcher, assignor to Peru Electric Co., Peru, Ind. Has two transverse grooves on opposite sides and ends, the bottom of each groove being larger and the top smaller than the wire loop

1,028,107. Electrically Heated Culinary Apparatus. W. S. Hadaway, Jr., and E. E. Rose, assignors to Westinghouse Electric & Manufacturing Co. The heating elements consist of flattened insulated helices between the outer and inner bottom walls.

1,028,108. Forming Press. E. Haefely, assignor to Westinghouse Electric & Manufacturing Co. Has bottom, top and side pressure plates to compress heavy armature or field conductors and their insulating sleeves.

1,028,112. Means for Counteracting Arcs. R. E. Hellmund, assignor to Westinghouse Electric & Manufacturing Co. An oil switch having links and springs to cause quick separation of the switch members.

1,028,118. Tubular Incadescent Lamp. E. R. Knowles, New York, N. Y. Includes two-part spring anchors for the filament ends, the anchors being fused into the glass tube and connecting with the leading-in wires.

1,028,150. Electrode Collar for Electric Furnaces. E. R. Taylor, Penn Yan, N. Y. Has double co-operating wedges surrounding the electrode and forming a gas-tight bushing in the furnace wall.

1,028,173. Safety Fuse. H. A. Yates, New York, N. Y., assignor to Y. & G. Electric Fuse & Engineering Co. A cartridge fuse with fusible segmental rings near each end connected by a fusible spider and the fuse strip.

1,028,189. Spring Joint for Trolley Poles. R. F. Coleman, Philadelphia, Pa. A resilient connection between the harp and fork.

1,028,200. Spark Plug. C. C. Eldridge and E. J. Beebe, Marshalltown, Ia. Provides for cleaning the electrodes.

1,028,202. Electric Magneto Machine. G. W. Foye, assignor to D. C. Foye, Philadelphia, Pa. The armature is driven by a power-transmitting ring supported on rollers.

1,028,204. Method of and Apparatus for Producing Electric Oscillations. R. C. Galletti, Rome, Italy. A number of oscillatory circuits are charged and discharged successively from a direct-current source.

1,028,232. Coin-Controlled Circuit-Closing Apparatus. J. E. Lewis, Philadelphia, Pa., assignor of one-third to W. B. Matthews. Insertion of a coin actuates an electromagnet and starts a motor.

1,028,253. Guard Device. T. E. Murray, New York, N. Y. A seal for a meter composed of a shell divided into two flexibly connected parts.

1,028,254. Meter-Testing Cutout. T. E. Murray, New York, Provides means for connecting in the leads an auxiliary load and fuse and test instruments.

1,028,255. Fuse Case, T. E. Murray, New York, N. Y. A tubular case with the terminals brought out at right angles on the side.

1,028,256. Electric Cutout. T. E. Murray, New York, N. Y. Has a number of U-shaped contact plates connecting to the branch circuits.

1,028,257. Joint for Sheathed Conductors. T. E. Murray, New York, N. Y. Presses lead floss in the opening around the lead sheath.

1,028,258. Electric Cutout. T. E. Murray, New York, N. Y. A plug containing a cartridge fuse and longitudinal knife-blade terminals fits into a box with corresponding clips.

1,028,259. Connection Device for Circuit Conductors. T. E. Murray, New York, N. Y. A special contruction for a cutout base block.

1,028,260. Junction Box for Circuit Conductors. T. E. Murray, New York, N. Y. For lead-covered power cables; has an iron casing to which the sheaths are grounded by lead floss.

1,028,268. Case for Meter-Connection Blocks. G. E. Palmer, assignor to Metropolitan Engineering Co., New York, N. Y. Has an open end closed by attachment to the meter casing.

1,028,277. Current-Controlling Mechanism for Internal-Combustion Engines. L. T. Rhodes, Mont Clare, Pa. An ignition timer.

1,028,328. Electric Fuse. G. W. Christians, New York, N. Y. An insulating rod with conducting end caps has parallel fuse strips joining the cap and in turn protected by a sheath.

1,028,332. Automatic Motor Control. M. W. Day, assignor to General Electric Co. For hoisting motors; includes a limit switch for connecting the motor for dynamic braking.

1,028,350. Electric Switch. M. Guett, assignor to Hart & Hegeman manufacturing Co., Hartford, Conn. A push-button flush wall switch.

1,028,354. Galvanic Battery. A. Heil, Frankfort-on-the-Main, Germany. A dry cell in which the zinc is gradually amalgamated during use.

1,028,360. Circuit-Controlling Device. F. Kastner, assignor to General Electric Co. Electric remote-control system for operating a set of rheostats.

1,028,364. Self-Starting Direct-Connected Generator. C. D. Knight, and W. O. Lum, assignors to General Electric Co. The generator starts the engine as a shunt motor and is then automatically connected to the load circuits.

1,028,370. Telephone Attachment. T. I. Ludwig, Sandusky, O. A device for holding the receiver to a person's ear.

1,028,383. Electric Heater. L. F. Parkhurst, assignor to General Electric Co. Has a flat heating unit yieldingly clamped to the bottom of the dish.

1,028,385. Electromagnet. E. Price, assignor to General Electric Co. For applying a band brake on a motor.

1,028,390. Winding Machine. G. H. Rupley, assignor to General Electric Co. Is driven by a series motor and has means for feeding the wire to the winding spindle.

1,028,394. Apparatus for Actuating the Conduit Covers of Electric Railways. D. Samaia, Vicenza, Italy. A system of levers is mounted on the car for forcibly moving the covers apart.

1,028,405. Selective Alternating-Direct-Current System. J. F. Tritle, assignor to General Electric Co. Provides rearrangement of the car circuits for operating either on high-potential single-phase current or low-potential direct current.

1,028,414. Power Generator. V. C. de Ybarrondo, Los Angeles, Cal. The tender of a steam locomotive has an electric generating plant which is connected to a set of electrodes in the boiler.

1,028,429. Swivel-Plug Attachment. A. W. Buell, assignor to Federal Electric Co., Chicago, Ill. A two-part attachment plug with rotatable threaded shell.

1,028,435. Animal Trap. J. B. Cessna, Pittsburgh, Pa. Includes an electrocution platform.

1,028,444. Protective Covering for Resistance Conductors. J. T. H. Dempster, assignor to General Electric Co. Comprises aluminum oxide and an aluminate about which is mica insulation.

1,028,488. Magnetic Speed Indicator. L. Le Pontois, assignor to A. R. Mosler & Co., New York, N. Y. Including a magnet having inner and outer annular flanges, a vibratory element carried by one flange, and an armature provided with annular teeth between the other flange and the vibratory element.

1,028,495. Electric Self-Playing Violin. H. K. Sandell, assignor to Mills Novelty Co., Chicago, Ill. Includes a motor for driving rotary sounders, an electric mechanism for moving them relative to the instrument strings and an electric expression mechanism.

1,028,514. Igniter or the Like. W. C. Westaway, assignor to Chicago Pneumatic Tool Co., Chicago, Ill. A spark plug with tubular electrodes.

1,028,516. Production of Continuous Elecric Arcs and Apparatus Therefor. F. H. A. Wielgolaski and O. Schonherr, assignors to Badische Anilin & Soda Fabrik, Ludwigshafen-on-the Rhine, Germany. Arcs are carried from the edge to the center of the furnace by means of a stream of gas.

1,028,519. Machine for Winding Wire on Thermostatic Springs. T. H. Wurmb and R. Baumann, assignors to National Clock & Electric Manufacturing Co., St. Louis, Mo. Has a revolving head carrying feeding devices.

1,028,534. Insulator. C. C. Brady, Ezra, Ky. Has a rectangular body with a wire-receiving groove on the top face and a hook bolt securing the wire.

1,028,536. Switch for Jump Spark Ignition systems. E. D. Bright, assignor to Connecticut Telephone & Electric Co., Meridian, Conn. Has four positions controlling the battery and magneto circuits.

1,028,554. Hydroelectric Unit. W. A. Doble, asignor to M. E. Doble, San Francisco, Cal. A tortuous air connection between the discharge pit of the water wheel and the generator pit

provides induced ventilation for the latter.

1,028,568. Electric Lock. W. S. Henry, assignor to General Railway Signal Co., Gates, N. Y. A signal lock with a pivoted sector, a latch spring and dog.

1,028,579. Connector for Conduits and Pipes. G. A. Lutz, Plainfield, N. J. A box for joining round metal conduit and rectangular metal molding at right angles.

1,028,580. Electric Sadiron. E. H. Lux, Logansport, Ind. Has a terminal post of special construction for the attachment of the supply circuit.

1,028,591. Signaling Apparatus. J. Moyes, Glasgow, and C. A. Stevenson, Edinburgh, Scotland. Comprises a sound intensifier, an explosion chamber to which gas is periodically supplied, and electric sparking devices for propucing explosions.

1,028,613. Battery-Element Support. B. Schoenmehl, Waterbury, Conn. Consists of a frame surrounding the electrode and supported from the cover.

1,028,614. Primary Battery. C. B. Schoenmehl, Waterbury, Conn. Includes an arrangement of the positive and negative electrodes with an insulating block between them.

1,028,104.—Strain Insulator.

1,028,619. and 1,028,620. Apparatus for Charging Open-Hearth Furnaces and the Like. J. Smith, assignor to Babcock & Wilcox Co., Bayonne, N. J. An electrically operated traveling structure with a carriage thereon, a turntable charging outfit and a trolley.

1,028,629. Trolley. S. de C. Stone, Somerville, Mass. On each side of the trolley wheel is an eccentric disk with tapering circumferential groove for guiding the trolley wire to the wheel.

1,028,635. Telephone System. D. L. Temple, assignor to Stromberg-Carlson Telephone Manufacturing Co., Rochester, N. Y. The exchange switchboard has special means for signaling and testing subscribers' lines.

1,028,636. Method of Exhausting Vessels. C. J. Thatcher, Upper Nyack, N. Y. Incandescent lamps are first mechanically exhausted and then heavy current is sent through the filaments to use up the residual gas.

1,028,639. Insulated Switch Cover. A. A. Tirrill, Schenectady, N. Y. Insulation for the metallic cover of a pull switch.

1,028,647. Fuse. G. R. Willett, Pittsburgh, Pa. A cartridge fuse with the ends of the fuse element passing through slots in the ends of the shell and secured to supporting screws.

1,028,668. Support for Third Rails. E. J. Blair, Chicago, Ill. On top of a beam are clamping members to hold the flanges of the rail.

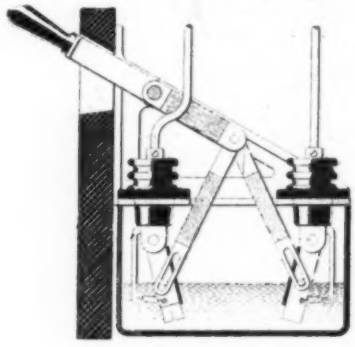
1,028,712. Lid for Cooking Utensils. A. Gregory, Durango, Mexico. A chafing-dish cover containing an electric heating element.

1,028,715. Maximum-Indicating and Watt-Hour Meter. C. I. Hall, assignor to Minerallac Electric Co., Chicago, Ill. Has a separate mechanism to register the maximum demand for definite time intervals.

1,028,719. Electric-Lamp Socket. H. T. Hartwig, assignor to Arrow Electric Co., Hartford, Conn. Has a resilient corrugated lining between the shell and body to take up the play between them.

1,028,731. Controlling Apparatus for Electric Motors. J. D. Ihlder, assignor to Otis Elevator Co., Jersey City, N. J. Includes a differential relay for applying the brake to an elevator motor when it attains excessive speed or acts as a generator.

1,028,748. Filaments and Other Products Obtained from Cellulose Compounds. L. Lederer, Sulzbach, Germany. A cellulose-ester compound is squirted, denitrated and disacetylized.



1,028,112.—Oil Switch.

1,028,785. Trolley Adjuster. W. J. Reeder, Louisville, Ky. A tubular casing on top of the car contains a spring-pressed fork engaging the trolley pole.

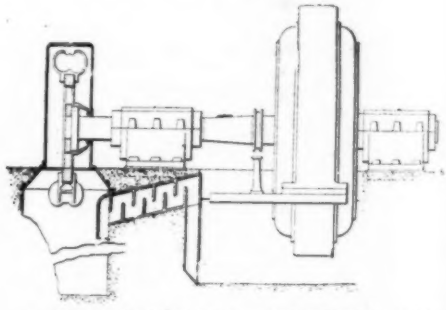
1,028,786. Electroplating Apparatus. M. Reid, Cleveland, O. Consists of a tiltable barrel containing a basket that supports the electrodes.

1,028,790. Signaling System. H. O. Rugh, assignor to Sandwich Electric Co., Sandwich, Ill. A call box whose contact arm makes different circuit connections depending on the direction of its rotation.

1,028,808. Means for Preventing the Freezing of Water in the Circulating Systems of Automobile Engines. H. S. Campbell, Baltimore, Md., assignor of one-third to J. Zill and one-third to P. T. de Mattos. An electromagnet opens a drain valve below the radiator when freezing temperature is approached.

1,028,827. Insulated-Wire-Saturating Machine. P. A. Nehring, assignor to Nehring Insulated Wire & Manufacturing Co., Sycamore, Ill. The wire is drawn over a wire-dipping drum in the tank and through a wiper board.

1,028,832. Furnace for Sintering Metallic Filaments for Electric Incandescent Lamps. C. Trenzen and E. Haagn, said Haagn assignor to W. C. Heraeus Gesellschaft M. B. H. Hanau, Germany. Includes a tube of pure iridium through which heating current is passed.



1,028,554.—Ventilation for Hydroelectric Unit.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired June 11, 1912:

540,620. Electric Circuit. W. W. Alexander, Kansas City, Mo.

540,642. Automatic Electric Railway-Signal. W. Daves, Jersey City, N. J.

540,653. Supply System for Electric Railways. O. A. Enholm, New York.

540,664. Electric Railway. S. Hoeninger, Milwaukee, Wis.

540,668. Regulation of Alternating Generators. R. M. Hunter, Philadelphia, Pa.

540,685. Electric Brake. W. B. Potter, Schenectady, N. Y.

540,687. Covering for Electric Wires. F. S. Randall, Philadelphia, Pa.

540,761. Telephone. W. W. Scott, Buffalo, N. Y.

540,772 Photo-Telegraph. C. Willoughby, San Francisco, Cal.

540,781. Telephone Transmitter. D. Drawbaugh, Eberly's Mill, Pa.

540,800. Electric Arc Lamp. S. P. Parmly, Chicago, Ill.

540,859. Electric Railroad Signal. B. H. Gedge, Anderson, Ind.

540,899. Telegraphic Apparatus. L. Boudet and P. Lacombe, Lumel, France.

540,900. Conduit Electric Railway. D. Brooks, Jr., Philadelphia, Pa.

540,901. Conduit-Railway Conductor. D. Brooks, Jr., Philadelphia, Pa.

540,949. Electrical Push-Button. E. A. Clark, Cleveland, O.

540,959. Telephone Transmitter. D. Drawbaugh, Eberly's Mill, Pa.

540,960. Carbon-Holder for Telephones. D. Drawbaugh.

540,961. Telephone Electrode. D. Drawbaugh.

540,969. Telephone. S. D. Field, Stockbridge, Mass.

540,974. Multiplex Telegraphy. D. B. Grandy, Et. Louis, Mo.

541,001. Electric Carriage. H. G. Morris and P. G. Salom, Philadelphia, Pa.

541,019. Electric Wire Lock and Support. D. W. Smith, St. Louis, Mo.

541,020. Conduit Electric Railway. D. W. Smith, St. Louis, Mo.

541,024. Electromagnetic Combination-Lock. E. Stockwell and H. C. Stockwell, Stamford, Conn.

541,036 and 541,037. Telephone Transmitter. C. Clamond, Paris, France.